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SPENCER, KENNETH A. A synopsis of the Oriental AGROMYZIDAE (DIPTERA) . . . . . 55–100, 48 figs.

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A SYNOPSIS OF THE ORIENTAL AGROMYZIDAE (DIPTERA)

By Kenneth A. Spencer
(19, *Redington Road, London, N.W.*3)

Manuscript received 30th September, 1960

(Read 7th December, 1960)

With 48 Text-figures

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I. Introduction

This paper is, in the main, a collation of the papers on the Agromyzidae from Formosa by Malloch (1914) and from Java by de Meijere (1910, 1914, 1917, 1922, 1938, 1940), together with additional material from India and Malaya in the British Museum (Natural History) and also material collected by the author in January and February, 1960, in India, Thailand, the Philippines, Singapore and Ceylon. One species is included from Southern China and the material collected by Rensch on the Sunda Expedition to Lombok, Sumbawa and Flores has also been examined.

A total of 80 species is now recorded for the Oriental region. Although it seems certain that this is only a fragment of the Agromyzidae present in the region, the keys which have now been prepared will permit identification of new material and will provide a framework which it is hoped will be of assistance to future workers.

The distribution of genera is on the whole similar to that in the Ethiopian region, although in certain cases the percentage represented by individual genera appears to differ significantly.

Only 14 species, however, are common to both the Oriental and Ethiopian region. These fall into three clear groups :

1. Species on cultivated plants, such as *Melanagromyza phaseoli* (Tryon) and *Liriomyza brassicae* (Ril.), whose natural distribution has almost certainly been widened by man.
2. Semi-cosmopolitan species, such as *Phytobia humeralis* (v. Ros.), *Phytoliriomyza perpusilla* (Mg.) and *Phytomyza atricornis* Mg.
3. Species feeding on plants of wide distribution, such as *Agromyza pallidifrons* Spencer on *Gramineae* and *Pseudonapomyza alternantherae* (Séguy) on *Achyranthes aspera*.

It is interesting to find that, conversely, cases occur where species feeding on the same plant or botanical genus are different in the two regions. Examples are *Melanagromyza passiflorae* Hg. in Africa and *M. atomella* (Mall.) in Asia, both on *Passiflora foetida* ; and *Agromyza penniseti* Spencer in Africa and *A. pennisetivora* Spencer in India, both on *Pennisetum*.

The following table shows the number of species in each genus in these two regions and also in Madagascar (Spencer, *in press*).

	Oriental Region		Ethiopian Region		Madagascar	
	Number of species	Percentage	Number of species*	Percentage	Number of species	Percentage
Agromyza	13	16	18	13	4	12
Japanagromyza	3	4	1	1	.	.
Penetagromyza	.	.	1	1	.	.
Melanagromyza	28	35	68	48	18	55
Ophiomyia	4	5	13	9	1	3
Cerodontha	1	1+	2	1+	.	.
Phytobia	15	19	11	8	1	3
Liriomyza	6	8	6	4	1	3
Phytagromyza	1	1+	2	1+	4	12
Pseudonapomyza	4	5	4	3	2	6
Phytoliriomyza	1	1+	1	1	.	.
Phytomyza	4	5	13	9	2	6
Napomyza	.	.	2	1+	.	.
Total	80		142		33	

* Including 10 undescribed species recently collected by Prof. Hering in Abyssinia.

The dominance of *Melanagromyza* is well illustrated by the Sunda Expedition material, which consisted of 675 specimens ; of these 660 belonged to 14 species of this genus, while the 15 remaining specimens belonged to 9 species in 6 of the smaller genera.

It is of interest to note that *Melanagromyza* is still completely dominant in Flores, at the eastern end of the Sunda islands, which in certain groups, such as birds and reptiles, tends to show Australian rather than Oriental affiliations. The Agromyzidae of Australia are still almost entirely unknown and there is inadequate evidence even to suggest the generic distribution which is likely to be encountered.

Agromyzidae from Micronesia which have recently been examined by the author appear to be definitely associated with those of the Oriental region. In Japan, there are elements of Oriental origin, such as epidermal leaf-miners belonging to *Melanagromyza*, but the distribution of genera clearly shows the palaearctic origin of the majority of species, with *Phytomyza* and *Liriomyza* the dominant genera. The species from Formosa, on the other hand, are typically Oriental, with the single exception of the Palaearctic species *Phytomyza robustella* Hendel.

II. Acknowledgments

During the preparation of this paper, I have received facilities for study or the loan of material from the following, to whom my best thanks are due:

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The text-figures have been largely prepared by my wife and it gives me great pleasure to record here my gratitude for her assistance.

III. Abbreviations

acr, acrostichal hairs.
dc, dorso-central bristle(s).
prsc, prescutellar bristles.
ors, upper fronto-orbital bristle(s).
ori, lower fronto-orbital bristle(s).
sa, supra-alar bristle.
vti, inner vertical bristle.
vte, outer vertical bristle.
rm, anterior cross-vein.
D.E.I., Berlin, Deutsches Entomologisches Institut, Berlin.

Specimens collected by the author are indicated (*K. A. S.*).
Drawings: the scale line, unless otherwise indicated, represents 0·5 mm.

IV. Systematic Treatment

1. Key to Genera

1	Subcosta developed throughout its length, coalescing with *r1* before reaching costa	2
–	Subcosta becoming a fold distally and ending in costa separately and basad of *r1*	5
2	Prescutellar bristles present	3
–	Prescutellar bristles lacking	4
3	Three or more pairs of dorsocentral bristles present	**Agromyza** Fallén
–	Only two pairs of dorsocentrals present	**Japanagromyza** Sasakawa
4	Facial keel between antennae prominent	**Ophiomyia** Braschnikov
–	Facial keel narrow and flattened	**Melanagromyza** Hendel
5	Two scutellar bristles	**Cerodontha** Rondani
–	Four scutellar bristles	6
6	Orbital setulae erect or reclinate, sometimes weak or absent	7
–	Orbital setulae proclinate, well developed	10
7	Costa reaching *m1* + *2*	8
–	Costa only reaching *r4* + *5*	9

8 Scutellum normally same colour as mesonotum, black or grey; if yellow, mid-tibiae with one strong bristle (*diversata* Spencer) . . . **Phytobia** Lioy
– Scutellum yellow, at least centrally . . . . . **Liriomyza** Mik
9 Lower (second) basal cell and discal cell confluent, basal section of vein *m3* + *4* lacking; second costal segment conspicuously short, at most twice length of fourth . . . . . **Pseudonapomyza** Hendel
– Lower (second) basal and discal cells distinct; second costal segment at least two and a half times length of fourth . . . . **Phytagromyza** Hendel
10 Costa reaching apex of *m1* + *2* . . . . . **Phytoliriomyza** Hendel
— Costa only reaching apex of *r4* + *5*; second cross-vein lacking **Phytomyza** Fallén

2. **Agromyza** Fallén

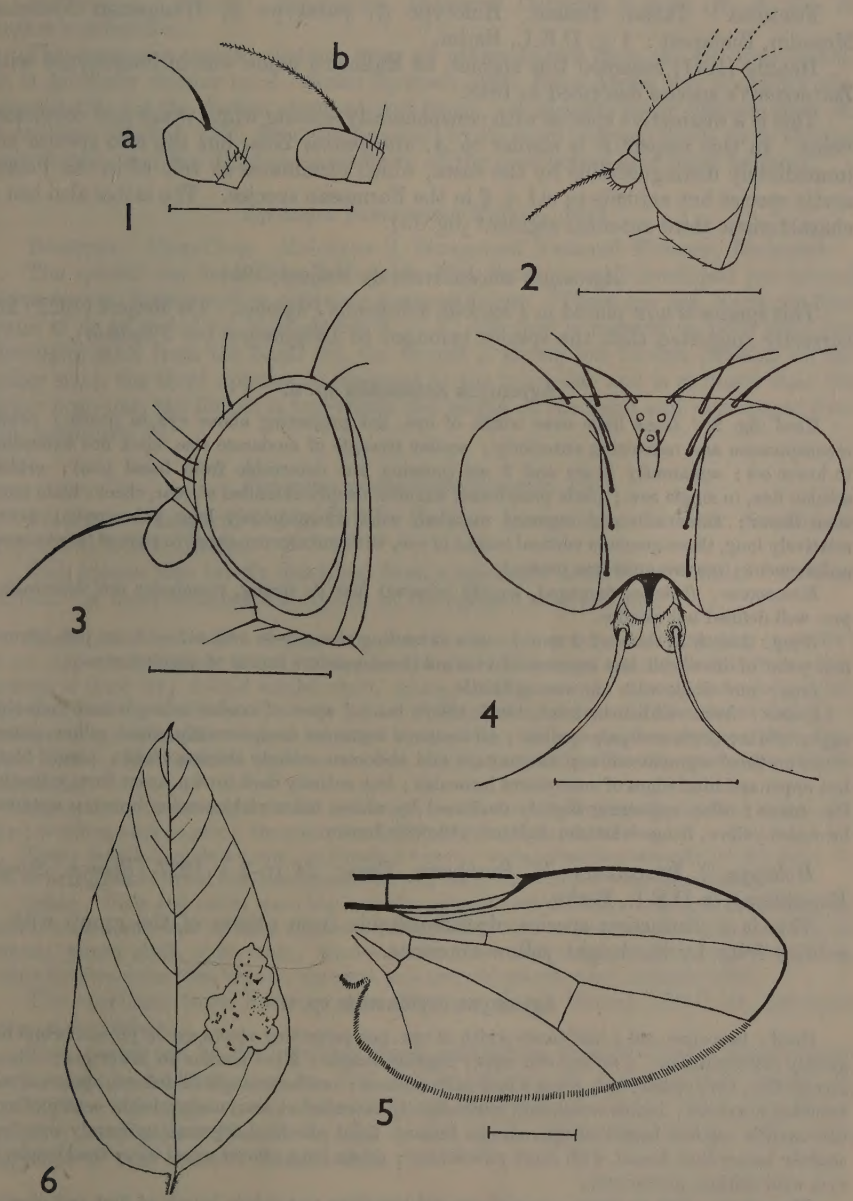
This genus consists of 13 species in the Oriental region, representing 16 per cent. of the total; this is only somewhat higher than the 13 per cent. accounted for by this genus in the Ethiopian region.

The food-plant is known for only five species, four being leaf-miners on Gramineae and the fifth on *Tephrosia* (Leguminosae).

The Oriental species can be identified by the following key:

0 Antennae entirely bright yellow, third segment and arista conspicuously pubescent; mesonotum shining black . . . . . **antennalis***
– This combination of characters not present 1
1 Pre-scutellar dorso-central bristle well developed, 4 + 1 *dc* **flavisquama** Malloch
– No pre-scutellar *dc* present 2
2 Squamal fringe pale, whitish or ochreous 3
– Squamal fringe dark, brown or black 9
3 Costa terminating at vein *r5* 4
– Costa extending to vein *m1* + *2* 5
4 Frons dark brown; all antennal segments black . . . . . **hordei***
– Frons conspicuously reddish; first and second antennal segments reddish **pennisetivora***
5 Wings conspicuously whitish, veins colourless . . . . . **albidipennis** Hennig
– Wings normal, veins brown or black 6
6 Frons brown in front, conspicuously projecting above eye . **pallidifrons** Spencer
– Frons black, not projecting 7
7 Jowls rounded, deepest in centre below eye; small species, wing length 2·2 mm. . . . . **tephrosiae** de Meijere
– Jowls angular, extended at rear; larger species, wing length 2·4–2·9 mm. 8
8 Squamae and fringe silvery-white; antennae entirely black; 3 *ori*; last segment of vein *m4* short, half length of penultimate . . . **plebeia** Malloch
– Squamae grey, fringe ochreous; second and third antennal segments partly brownish; 2 *ori*; last segment of *m4* longer, two-thirds penultimate **graminivora** Spencer
9 Small species, wing length 1·9 mm.; third antennal segment with conspicuously long pubescence . . . . . **latipennis** Malloch
– Larger species, wing at least 2·7 mm.; third antennal segment normal . 10
10 Squamae dark grey, fringe black; third antennal segment black . **ceylonensis***
— Squamae yellowish, fringe contrasting dark brown 11
11 Antennae entirely black, arista plumose; tarsi pale brown; large species, wing length 3 mm.; last segment of vein *m4* little over half length of penultimate . . . . . **obesa** Malloch
— Third antennal segment distinctly brownish, arista not conspicuously pubescent; tarsi darker; smaller species, wing 2·4 mm.; last segment of *m4* only slightly shorter than penultimate . . . . . **panici** de Meijere

* Species marked with an asterisk are described as new in this paper.



FIGS. 1–6.—(1–3) *Agromyza*: (1) antennae of (*a*) *albidipennis* Hennig, (*b*) *plebeia* Malloch; (2) *antennalis* sp. n., head; (3) *hordei* sp. n., head. (4–5) *Japanagromyza*: (4) *angustifrons* sp. n., head; (5) the same, wing; (6) *variihalterata* (Mall.), leaf-mine on *Glycine soja*.

Agromyza albidipennis Hennig, 1941

Agromyza niveipennis Malloch, 1914.
Agromyza albidipennis Hennig, 1941, *nom. nov.* pro. *niveipennis* Malloch, *nec* Zetterstedt, 1848.

Formosa: Takao, Tainan. Holotype ♂, paratype ♀, Hungarian National Museum, Budapest; 1 ♂, D.E.I., Berlin.

Hennig (1941) renamed this species, as Malloch's name was in homonymy with Zetterstedt's species described in 1848.

This is a distinctive species with conspicuously shining white wings and colourless veins. In this respect it is similar to *A. niveipennis* Zett. but the two species are immediately distinguishable by the costa, which terminates at vein *r5* in the Palaearctic species but extends to *m1* + *2* in the Formosan species. The latter also has a characteristic third antennal segment (fig. 1*a*).

Agromyza albohalterata de Meijere, 1914

This species is now placed in *Phytobia*, sub-genus *Phytobia*. De Meijere (1922 : 23) correctly suggested that the species belonged to *Dizygomyza* (= *Phytobia*).

Agromyza antennalis sp. n.

Head (fig. 2): frons little over width of eye, not projecting above eye in profile; orbits inconspicuous and narrowing anteriorly; ocellar triangle of moderate size, apex not extending to lower *ors*; apparently 2 *ors* and 2 *ori* (missing but detectable from basal pits); orbital setulae fine, in single row; jowls prominent, angular, deeply extended at rear, cheeks little more than linear; third antennal segment rounded, with conspicuously long pubescence; arista relatively long, three-quarters vertical height of eye, with pubescence equal to that of third antennal segment; narrow epistoma present.

Mesonotum: (bristles damaged, largely missing) first *dc* strong, remainder not detectable; *prsc* well defined but slender.

Wing: length in female 2·2 mm.; costa extending strongly to vein *m1* + *2*, *rm* just beyond mid-point of discal cell, last segment of vein *m4* three-quarters length of penultimate.

Legs: mid-tibiae with one strong bristle.

Colour: frons reddish in front, black above behind apex of ocellar triangle and including upper orbits; jowls and palps yellow; all antennal segments conspicuously bright yellow, pubescence on third segment white; mesonotum and abdomen entirely shining black; pleura black but upper and hind edges of mesopleura brownish; legs entirely dark brown, apart from yellowish fore coxae; wing appearing slightly darkened by coarse microtrichia, veins brown; squamae brownish-yellow, fringe whitish; halteres yellowish-brown.

Holotype ♀, Indonesia: W. Sumbawa, Besar, 24.iv–2.v.1927 (*Rensch, Sunda Expedition*), in D.E.I., Berlin.

This is a distinctive species, distinguishable from others of the group with a reddish frons by the bright yellow antennae.

Agromyza ceylonensis sp. n.

Head: frons one and a half times width of eye, not projecting above eye in profile, orbits not greatly differentiated; 2 strong *ors*, upper slightly longer; 2 *ori* similar to lower *ors*; orbital setulae fine, very sparse, only some 4 or 5 hairs present; ocellar triangle ill-defined, apex scarcely reaching lower *ors*; lunule small, low, jowls slightly extended at rear, narrow below centre of eye, one-twelfth vertical height of eye, cheeks linear; third antennal segment uniformly rounded, slightly longer than broad, with short pubescence; arista long, almost equal to vertical height of eye, with distinct pubescence.

Mesonotum: first *dc* strong, normal, second less than two-thirds length of first and shorter than pre-scutellars, third half length of second; fourth, if present, cannot be detected (mesonotum slightly damaged); *acr* numerous, regular, in eight rows.

Wing: length in male 2·6 mm.; costa extending weakly to vein *m1* + *2*, *rm* just before mid-point of discal cell, last segment of *m4* in ratio 18 : 25 with penultimate.

Legs: mid-tibiae with 2 strong postero-dorsal bristles.

Colour : an all black species. Frons matt, ocellar triangle only weakly shining ; mesonotum and abdomen shining black ; pleura and legs uniformly black ; wings hyaline, veins black ; squamae dark grey, fringe black ; halteres white.

Holotype ♂, CEYLON : Peredeniya, Botanical Gardens, 2.ii.60 (*K. A. S.*), in author's collection.

This species is entirely distinct from all others known from the Oriental region. It is generally similar to *A. oliviae* Spencer, 1959, from Africa but is readily distinguishable by the darker squamae and fringe ; it appears to be distinct from *A. munduleae* (Séguy), 1951, from Madagascar, by its more plumose arista, more shining mesonotum, and the differing chaetotaxy of the mesonotum and paler halteres.

Agromyza flavisquama Malloch, 1914

FORMOSA : Chip-Chip. Holotype ♀, Hungarian National Museum, Budapest.

The species can be readily distinguished by having a well-developed pre-sutural dorso-central bristle and a yellowish squamal fringe. There are not, however, four pairs of *dc* as stated by Malloch but *4 + 1* ; the first is missing on both sides but distinguishable from the basal pit, the second is strong but broken (missing on the other side), the third appears to be equal to the intra-alar and is stronger than the inner post-alar, the fourth is two-thirds the length of the third and just longer than the presutural *dc*.

Agromyza graminivora Spencer, 1960

FORMOSA : Taihoku, 1 ♀ in D.E.I., Berlin. INDONESIA : Lombok, Sembaloen, 1 ♂, 1 ♀ in D.E.I., Berlin.

This species was briefly described from a specimen bred from " millet " in West Africa. A more detailed description of the species now follows :

Head : frons little wider than eye, in ratio 12 : 10 with eye, eye not projecting in profile ; 2 *ors*, upper only slightly longer ; 2 equal *ori*, similar to lower *ors*, a minute hair in front, representing a third *ori* ; orbital setulae short, sparse ; ocellar triangle scarcely extended beyond foremost ocellus ; lunule small, narrow ; jowls slightly extended at rear, below centre of eye very narrow, only one-twelfth vertical height of eye ; cheeks linear ; epistoma narrow, little more than linear ; third antennal segment rounded, slightly longer than broad ; arista long, slightly pubescent.

Mesonotum : two strong *dc*, third and fourth small, scarcely distinguishable from coarse *acr* ; *acr* extending back to *prsc* ; these strong, slightly shorter than second *dc*.

Wing : length in male 2·4 mm., in female 2·6 mm. ; costa extending strongly to vein *m1 + 2* ; *rm* at mid-point of discal cell, last segment of vein *m4* in ratio 18 : 25 with penultimate.

Colour : frons and orbits matt black, ocellar triangle not shining ; antennae predominantly black, second and base of third segments faintly brownish ; mesonotum and abdomen shining black ; pleura black, more matt ; femora black, tibiae and tarsi contrasting pale brownish ; wings hyaline, veins dark brown ; squamae pale grey, fringe ochreous ; halteres white.

The specimen from Formosa was determined by Hennig (1941) as *Agromyza* spec. near *plebeia*.

The species can be distinguished from *pallidifrons* Spencer by the darker frons and antennae and stronger *ors* and *ori*, which are all approximately equal ; in *pallidifrons* the single *ors* is substantially stronger than the 3 *ori*. It can be distinguished from *plebeia* Malloch by the darker, ochreous squamal fringe, longer last segment of vein *m4* and darker veins.

Agromyza hordei sp. n.

Head (fig. 3) : frons broad, twice width of eye, projecting above eye in lower half ; 2 widely spaced *ors*, upper distinctly stronger ; 3 *ori*, upper 2 similar to lower *ors*, lower one very much weaker ; orbital setulae fine, sparse, reclinate ; orbits well defined, broad, all orbital bristles at inner margin ; ocellar triangle short, only extending slightly beyond upper *ors* ; lunule small,

narrow, totally enclosed by raised frons ; jowls deeply extended at rear, in centre below eye one-eighth vertical height of eye ; cheeks forming broad ring below eye ; third antennal segment large, characteristic ; arista relatively short, bare.

Mesonotum : 4 strong *dc*, fourth immediately before suture, preceded by 2 or more minute further bristles, scarcely stronger than acrostichals ; *acr* in 6–8 irregular rows.

Wing : length in female 2·8 mm. ; costa ending just beyond vein *r1*, *rm* at mid-point of discal cell, last segment of *m4* short, in ratio 20 : 38 with penultimate.

Legs : mid-tibiae with two weak postero-dorsal bristles.

Colour : frons matt black, tending to brown, orbits more distinctly black ; antennae and remainder of head black ; mesonotum largely matt, greyish-black, abdomen similar ; legs entirely black ; wings hyaline, veins dark brown ; squamae and fringe pale, white ; halteres yellowish.

Holotype ♀, INDIA : Delhi, 19.xii.1937, bred *ex* leaves of barley (*R. Saran*), in British Museum (Natural History).

This species is generally similar to *A. veris* Hering, 1951. It differs in having a significantly wider frons, more numerous acrostichals, *4 + 2 dc*, and also very much shorter last segment of vein *m4*.

Agromyza latipennis Malloch, 1914

FORMOSA : Takao. Holotype ♀ and 2 other specimens, Hungarian National Museum, Budapest.

Characteristic features of this species are the shining black mesonotum ; the thick, long pubescence on the third antennal segment ; the longer, upper *ors* ; and the small size. The wing length is 1·9 mm., not 1·25 as stated by Malloch.

Agromyza nigrita Malloch, 1914

This species is now placed in *Phytobia*, sub-genus *Phytobia*.

Agromyza obesa Malloch, 1914

FORMOSA : Sokotsu. Holotype ♀, Hungarian National Museum, Budapest.

Large, shining black species ; antennae entirely black, arista long, distinctly plumose ; jowls narrow ; tarsi pale brown, contrasting with remainder of legs ; costa weak beyond vein *r5* but can be taken as continuing to *m1 + 2*, last segment of *m4* short, little over half penultimate ; wings slightly fuscous, all veins pale brown.

Agromyza pallidifrons Spencer, 1959

INDIA: Bombay State College of Agriculture. 1 ♂, 1 ♀, bred from *Sorghum* sp. (" jowar ") ; Calcutta, Botanical Gardens, 1 ♂, 20.viii.1957.

The Bombay specimens agree closely with the holotype from Rhodesia and it is satisfactory that the biology of the species is now confirmed ; in the original description it was suggested that the species was probably a feeder on Gramineae.

A. graminivora Spencer, a closely related species, has a blacker and non-projecting frons.

Agromyza panici de Meijere, 1934

INDONESIA : Java, Tapos. 2 ♂, 1 ♀ in Zoological Museum, Amsterdam, bred from *Panicum palmifolium* Poir.

This species is predominantly black but the third antennal segment is distinctly brownish in the lower half and the squamae are pale, yellowish, though with a contrasting dark-brown fringe. The wing length is 2·4 mm. De Meijere (1934) also describes and figures the larva ; in a brief reference to the species (1950) he inadvertently places it in *Melanagromyza*.

Agromyza pennisetivora sp. n.

The three available specimens are all in very bad condition but the species is distinctive and a brief description can be given.

Head : frons one and a half times width of eye at foremost ocellus, conspicuously projecting above eye in lower half ; orbital bristles all short and slender ; one *ors* directed upwards, 2 equal *ori*, slightly smaller than *ors*, directed inwards ; orbital setulae slender, sparse ; orbits not greatly differentiated, ocellar triangle narrow, apex extending at most to upper *ori* ; lunule small, semicircular, upper margin well below lower *ori* ; jowls angular, deeply extended at rear, cheeks forming conspicuous ring below eye ; vibrissa weak, peristomal hairs slight ; antennae separated at base by conspicuously sharp facial keel (third antennal segment missing in all specimens) ; broad epistoma present.

Mesonotum : well-developed first *dc*, preceded by row of 4 smaller ones, no pre-sutural *dc* ; *acr* in some 6 irregular rows.

Wing : length in male and female 2·7 mm. ; costa extending only to vein *r5*, *rm* at apical third of discal cell, last segment of *m4* two-thirds length of penultimate.

Colour : frons, jowls and face conspicuously reddish-brown ; hind margin of eye and upper orbits black, orbits increasingly reddish at level of *ori* ; facial keel black ; first and second antennal segments reddish (third probably similar) ; all bristles on head slightly but distinctly reddish ; mesonotum matt black ; legs entirely black, wings and all veins conspicuously fuscous ; squamae and fringe whitish-yellow, halteres similar.

Holotype ♀, INDIA : New Delhi, 1958, bred from leaf-mine on *Pennisetum typhoideum* Rich. ; *allotype* ♂ and 1 ♂ paratype, same data. Holotype and allotype presented by Commonwealth Institute of Entomology to British Museum (Natural History), paratype in author's collection.

The African species, *A. penniseti* Spencer, 1959, also feeding on *Pennisetum*, has a dark brown frons, hyaline wings and costa extending to vein *m1 + 2*.

Agromyza plebeia Malloch, 1914

FORMOSA : Takao, Kosempo. Holotype and allotype in Hungarian National Museum, Budapest ; 1 ♀ in D.E.I., Berlin.

This all-black species closely resembles *albidipennis* Hennig but can be immediately distinguished by the smaller, uniformly rounded third antennal segment and more plumose arista (fig. 1*b*). Of the two *ors*, the lower is distinctly slighter than the upper and there are three equal, inverted *ori*. The wing has a noticeable yellowish tinge and all veins are pale, straw-coloured. The last segment of vein *m4* is short, half the length of the penultimate. Wing length 2·5–2·9 mm.

Agromyza tephrosiae de Meijere, 1917

INDONESIA : Java, Salatiga. Leaf-miner on *Tephrosia* ; 3 ♀ in Zoological Museum, Amsterdam, all in very poor condition.

De Meijere (1922) suggested the species belonged to *Dizygomyza* but after re-examination of the larva (1938 : 64) confirmed that it is correctly placed in *Agromyza*.

Small dark species ; frons dark brown, not projecting above eye in profile ; jowls relatively deep in centre below eye ; mesonotum shining black, with two strong *dc* (smaller third *dc* possibly present but not detectable in damaged specimens) ; wing (figured by de Meijere, 1917), length 2·2 mm., costa extending to vein *m1 + 2* ; squamae and fringe whitish.

3. Japanagromyza Sasakawa, 1958

This small genus consists of 12 world species and the known distribution is limited to the Ethiopian and Oriental regions, Japan and Micronesia. The host-plant is known for four species, the larvae in all cases forming conspicuous blotch-mines. *J. variihalterata* (Mall.) is possibly of economic importance, where the food-plants are cultivated leguminous crops such as *Glycine* and *Pueraria*.

The Oriental species of this genus can be identified by the following key :

1	Halteres entirely yellow	**sp. nov.** (Micronesia)
–	Halteres at least partially white or yellowish above or on inside, brown or black below or on outside	2
2	Fore tibiae with one or two bristles	3
–	Fore tibiae without bristles ; frons exceptionally narrow, two-thirds width of eye	**angustifrons***
3	Fore tibiae with one bristle	**variihalterata** (Malloch)
–	Fore tibiae with two bristles	**kalshoveni** (de Meijere)

Japanagromyza angustifrons sp. n.

Head (fig. 4) : frons exceptionally narrow, two-thirds width of eye, not projecting above eye in profile ; orbits not differentiated ; 2 stout but short, equal *ors* ; 2 *ori*, upper strong, only slightly weaker than *ors*, lower short, half length of upper ; all orbital bristles directed upwards ; orbital setulae virtually lacking, at most a single, small hair present ; ocellar triangle inconspicuous, apex not extending beyond upper *ors* ; lunule small, low, upper margin at level of lower *ori* ; jowls exceptionally narrow, linear ; vibrissa equal to lower *ori* ; antennae large, third segment widening distally ; arista long, equal to vertical height of eye, with distinct pubescence.

Mesonotum : 2 strong *dc* and additional small third *dc* present, distance between first and second twice that between second and third, second at level of intra-alar, third at level of *sa* ; *prsc* strong, equal to second *dc* ; *acr* coarse, in 8 rows, some hairs extending to *prsc* ; intra-alar and inner post-alar equal, scarcely weaker than second *dc*.

Wing (fig. 5) : length in male 2·6–2·7 mm. ; costa extending to vein *m1* + *2*, *rm* only slightly basad of mid-point of discal cell, last segment of *m1* conspicuously short, at most half penultimate.

Legs : fore tibiae without postero-dorsal bristles, mid-tibiae with 2 strong bristles.

Colour : frons matt black ; base of orbital bristles distinctly shining, ocellar triangle less so ; mesonotum shining black, only slightly more matt from front ; abdomen shining black ; legs largely black but all tarsi distinctly paler, brownish ; wings hyaline, veins brown ; squamae pale grey, fringe black ; halteres black on outside and above, on inside yellowish-brown, stalks similar.

Holotype ♂, Formosa : Maruyama, iv.1914 ; 1 *paratype*, Kankau, xi.1912 (both *H. Sauter*), both in D.E.I., Berlin.

The characteristic features of this species are the very narrow frons, absence of orbital setulae and of bristles on the fore-tibiae, the small third *dc*, plumose arista and predominantly dark halteres. With this combination of characters the species can be readily distinguished from the closely related *variihalterata* (Malloch) and *kalshoveni* (de Meijere).

The species was determined by Hennig (1941 : 175) as *Melanagromyza* spec. 4.

Japanagromyza kalshoveni (de Meijere), **comb. nov.**

Melanagromyza kalshoveni de Meij., 1934.

Indonesia : Java. Type specimens in Zoological Museum, Amsterdam, bred from leaf-mines on *Antidesma bunias* Wall.

This species is immediately recognisable as a *Japanagromyza* sp. by the presence of only two pairs of dorso-central bristles and a pair of strongly developed prescutellars. The halteres are merely stated in the description to be dark ; in fact they are largely dark brown but distinctly paler on the lower, inner side.

The species very closely resembles *J. variihalterata* (Mall.) but the halteres are less conspicuously white above. The posterior spiracles of the larva, figured by de Meijere (1934 : 255), have each 10 buds arranged in a regular ellipse. This arrangement is similar to *J. duchesneae* (Sasakawa) ; in *J. variihalterata*, *J. elaeagni* (Sasakawa) and *J. quercus* (Sasakawa) the arrangement is quite different and very distinctive, numerous small buds being situated laterally along each side of the three arms of the spiracular process.

Japanagromyza variihalterata (Malloch)

Agromyza variihalterata Malloch, 1914.
Japanagromyza variihalterata (Malloch), Spencer, 1960.
Agromyza koshunensis Malloch, 1914, **syn. nov.**

FORMOSA: Koshun, iii.1914. ♂ holotype, Hungarian National Museum, Budapest. 1 ♂, D.E.I., Berlin. Taipeh, 1958, bred from blotch-mines on *Glycine soja* Sieb. et Zucc.

INDONESIA: Java, Semarang; W. Flores, Rana Mese (Sunda Expedition), 20–30.vi.27 (*Rensch*).

SINGAPORE: 29.i.1960, larvae feeding in blotch-mines on *Pueraria phaseoloides* Benth. (*K. A. S.*).

CEYLON: Labugama, 31.i.60; Peredeniya, 2.ii.60, larvae feeding in blotch-mines on *Pueraria phaseoloides* (*K. A. S.*).

From the above records it is clear that this species is widespread throughout the Oriental region. It is so far only known to occur on Leguminosae, which are cultivated widely in the tropics, and this no doubt partially accounts for its widespread distribution.

The species is characterised by having two pairs of *dc*, strong pre-scutellars, the first cross-vein at the basal third of the discal cell and halteres brown below, irregularly white above; there are two very strong postero-dorsal bristles on the mid-tibiae and also one weaker bristle on the fore tibiae. The leaf mine on *Glycine soja* is shown in fig. 6.

I have examined the holotype of *Agromyza koshunensis* Malloch and synonymise the species with *variihalterata* herewith. The specimen in the D.E.I., Berlin, determined as *koshunensis*, is also referable to *variihalterata*.

The species also occurs in Japan on *Pueraria triloba* Makino and *Glycine soja* and the characteristic posterior spiracles of the larva were illustrated by Kuroda (1958) (as *Melanagromyza* sp.); Sasakawa (1958) briefly discusses the female terminalia of this species, bred from *Pueraria hirsuta* M. (as *Japanagromyza* sp.). I have also seen a lengthy series of specimens from MICRONESIA: Bonin Islands.

Japanagromyza **sp. nov.** (Micronesia)

INDONESIA: Java, Semarang, 1♂, i.1906, in Zoological Museum, Amsterdam.

This species is typical of the genus in having two pairs of *dc* and strongly developed pre-scutellars; it is distinctive in having entirely white halteres.

The type series, from Bonin, Pagan and Palau Islands, is being described in *Insects of Micronesia*.

4. **Melanagromyza** Hendel

This is the dominant genus in the Oriental region, with 28 known species, representing 35 per cent. of the total, and is almost twice as large as the second Oriental genus, *Phytobia*. However, it appears to be less important than in the Ethiopian region where it accounts for 48 per cent. of the total.

The recorded species include leaf-miners, internal stem-borers, root-feeders and gall-causers. Four species belong to the group of small, epidermal leaf-miners, which also occur widely in the Ethiopian region and are represented by a single species, *M. styricicola* Sas., in Japan. The author found the species of this group to occur on a wide variety of hosts in India and Ceylon. It is now considered that there are at least two highly polyphagous species, *M. atomella* (Mall.) and *M. polyphaga*, described below; there may well, however, be many more species limited to their own hosts, such as *M. theae* (Green) and *M. coffeae* (Kon.).

Among this genus are species causing considerable damage to cultivated plants: the most serious pests are *M. phaseoli* (Tryon), *M. obtusa* (Mall.), *M. theae* (Green),

M. centrosematis (de Meij.); *M. sojae* (Zehnt.) and *M. dolichostigma* de Meij. occur commonly on soya bean but the damage caused is not significant.

Experience with Palaearctic and African species of this genus has shown that groups of species exist in which differences in the adult are scarcely detectable, while the larvae (or puparia) are strikingly distinct. Few Oriental species have so far been bred and little assistance has thus been available from immature stages. Examination of male genitalia, however, has greatly helped in clarifying difficult groups such as *piliseta* (Mall.)—*metallica* (Thomson), *conspicua* sp. n.—*polyphaga* sp. n., *cordiophoeta* sp. n.—*compositarum* sp. n.

The Oriental species can be identified by the following key:

1	Squamal fringe pale, whitish	2
–	Squamal fringe dark, black or brown	16
2	Mesonotum predominantly black, at most with faint metallic tinge	3
–	Mesonotum distinctly green, coppery or bluish	6
3	Mesonotum and abdomen entirely shining black	4
–	Abdomen greenish-coppery or with conspicuous reddish or bluish tinge	5
4	Large species, wing length 2·6 mm.	**alternata***
–	Small species, wing length 1·9 mm.	**atralis***
5	Mesonotum shining black; jowls prominent, rounded; frons wider than eye; ocellar triangle large; abdomen greenish	**sojae** (Zehntner)
–	Mesonotum more matt, frequently purplish; jowls narrower; frons narrow, at most equal to width of eye; abdomen multi-coloured, greenish, bluish, reddish or purple	**dolichostigma** de Meijere
6	Very large green species, wing length 3·2–3·5 mm.; arista conspicuously plumose	**lasiops** (Malloch)
–	Smaller species	7
7	Ocellar triangle greatly enlarged, extending to margin of lunule, flat at apex; mesonotum greenish; large species, wing length 2·8–3 mm.	**obtusa** (Malloch)
–	Ocellar triangle smaller	8
8	Lunule conspicuously high and narrow, constricted by broadened orbits; mesonotum blackish-green	**hibisci***
–	Lunule lower, approximately in form of semicircle	9
9	Wing base conspicuously whitish; mesonotum green (*gall-causer on leaves of* Erythrina)	**erythrinae** (de Meijere)
–	Wing base darker	10
10	Mesonotum blackish-blue	**cleomae***
—	Mesonotum predominantly greenish	11
11	Eye entirely bare in male	12
—	Eye in male with distinct patch of hairs	14
12	Very small species, wing length 1·9–2·2 mm.	**leguminum** Bezzi, **producta** (Malloch)
—	Larger species	13
13	Wing length in male 2·3 mm.; distiphallus largely membranous, scarcely chitinised	**compositarum***
—	Wing length in male 2·5 mm.; more robust species; distiphallus (fig. 43) distinctive, strongly chitinised	**cordiophoeta***
14	Arista appearing bare	**gerberivora** Spencer
—	Arista distinctly pubescent	15
15	Wing length at least 2·6 mm.; distiphallus with black, strongly chitinised process	**piliseta** (Malloch)
—	Smaller species, wing length 2·2–2·4 mm.; distiphallus entirely pale, weakly chitinized	**metallica** (Thomson)
16	Frons not appreciably projecting above eye in profile	17
—	Frons conspicuously projecting	25
17	Costa extending only to vein *r5*	18
—	Costa distinctly extending to vein *m1* + *2*	19
18	Last and penultimate segments of vein *m4* equal	**coffeae** (Koningsberger)

— Last segment of *m4* distinctly shorter than penultimate . . . **theae** (Green)
19 Ocellar triangle long and narrow, shining black; small shining-black species . . . . . **phaseoli** (Tryon)
— Ocellar triangle shorter, less shining 20
20 Fore tibiae with strong bristle; large species, wing length 2·9 mm. **setigera** (Malloch)
— Fore tibiae without bristle 21
21 Mid-tibiae with two bristles; medium-sized species, wing length 2·5 mm. **ricini** de Meijere
— Mid-tibiae with at most one bristle; small species, wing length at most 2 mm. 22
22 Mid-tibiae with fine, short bristle; minute species, wing length 1·4–1·6 mm. (puparium yellow) . . . . . **atomella** (Malloch)
— Mid-tibiae with one strong bristle; larger species 23
23 Jowls narrow, one-tenth height of eye (puparium black) . . . . **polyphaga***
— Jowls broader, one-fifth to one-sixth height of eye 24
24 Third antennal segment with conspicuously long pubescence; mesonotum matt, at least from front . . . . . **conspicua***
— Third antennal segment not conspicuously pubescent; mesonotum shining black (puparium yellow) . . . . . **centrosematis** de Meijere
25 Mesonotum entirely matt, greyish-black; orbital setulae conspicuously long . . . . . **sauteri** (Malloch)
— Mesonotum largely shining-black; orbital setulae normal 26
26 Arista conspicuously plumose; jowls narrow, one-twelfth height of eye **subfusca** (Malloch)
— Arista bare or normally pubescent; jowls broader, at least one-sixth height of eye 27
27 Third antennal segment with conspicuous pubescence; wing length 2·3 mm. **provecta** (de Meijere)
— Third antennal segment normally pubescent; larger species, wing length 2·7 mm. . . . . **nigrisquama** (Malloch)

Melanagromyza alternata sp. n.

Head: frons one and a half times width of eye, not projecting above eye in profile; orbital bristles strong; 2 *ors* directed upwards, 2 only slightly weaker *ori* directed inwards; orbital setulae minute, sparse, reclinate; ocellar triangle large, becoming ill-defined towards apex which extends to lower *ors*; orbits narrow; lunule large, broad and somewhat higher than a semicircle, upper margin above level of lower *ori*, jowls exceptionally narrow, one-twelfth height of eye; third antennal segment rounded, with short, sparse pubescence; arista short, shorter than width of eye in profile, finely pubescent; mouth margin normal, without epistoma.

Mesonotum: 2 + 0 *dc*; *acr* short, numerous, in some 12 rows, extending in 6 rows to first *dc*.

Wing: length in female 2·6 mm.; costa extending strongly to vein *m1* + *2*, *rm* just beyond mid-point of discal cell, last and penultimate segments of *m4* in ratio 19 : 24.

Legs: mid-tibiae with one strong bristle.

Colour: frons matt black, orbits shining, ocellar triangle moderately shining but becoming matt towards apex; mesonotum and abdomen brilliantly shining black, with no trace of metallic coloration; legs entirely black; wings hyaline, veins black; squamae and fringe white, margins only slightly differentiated, more brownish; halteres brownish-black.

Holotype ♀, Formosa: Paroe, northern Paiwan District, x.1912 (*H. Sauter*), in D.E.I., Berlin.

This species most closely resembles *sojae* (Zehntner) but is readily distinguishable by the entirely shining black mesonotum and abdomen and by the larger size. In Africa there is no comparable shining black species with pale squamal fringe.

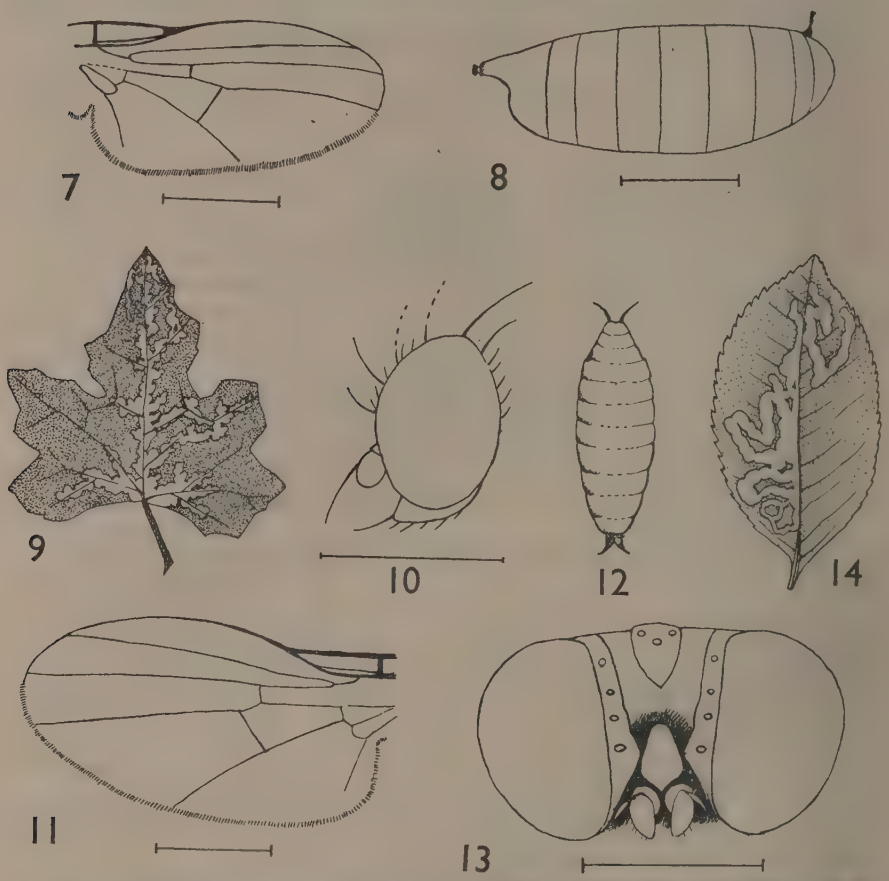
Melanagromyza atomella (Malloch)

Agromyza atomella Malloch, 1914.
Melanagromyza atomella (Malloch), Hennig, 1941.

Formosa: Pilam, 1912. Ceylon: Colombo, i.1960 (*K. A. S.*). Philippines: Luzon, Los Baños, i.1960 (*K. A. S.*).

I have examined the holotype of this species from the Hungarian National Museum, Budapest. It is one of the very small, black epidermal leaf-miners.

I have also examined five of the 20 specimens placed as paratypes, which Malloch stated to be variable; only one agrees with the holotype, two are *M. centrosematis* de Meij., one *M. phaseoli* (Tryon) and one probably *M. conspicua* Spencer.



FIGS. 7–14.—*Melanagromyza*: (7) *atomella* (Mall.), wing; (8) the same, puparium; (9) the same, leaf-mine on *Coccinia*; (10) *atralis* sp. n., head; (11) *coffeae* (Kon.), wing; (12) *dolichostigma* de Meij., puparium; (13) *hibisci* sp. n., head; (14) *theae* (Green), leaf-mine.

On 30.i.1960 I obtained epidermal leaf-mines with larvae and puparia on *Passiflora foetida* L. and *P. suberosa* L. at Colombo, Ceylon and the six flies I bred agree exactly with *atomella*. A single specimen caught in the Philippines on 26.i.1960 is also referable to this species.

The essential characteristics of the species are as follows:

Frons equal to width of eye, not projecting; jowls narrow, one-eighth height of eye, third antennal segment small, round, with slight pubescence; arista long, equal to vertical height of eye; mesonotum and abdomen only moderately shining black; mid-tibiae with fine, short bristle; wing length in female holotype 1·6 mm., in males 1·4 mm., costa extending to vein *m1* + *2* (fig. 7).

The silvery epidermal mine winds irregularly over the leaf, sometimes following the leaf-margin, sometimes in the centre of the leaf; the puparium remains in a

conspicuous pupal cradle on the upper surface, with the anterior spiracles projecting through the epidermis. The puparium (fig. 8) measures 1·9 × 0·8 mm. and is uniformly yellow, apart from the black, chitinised anterior and posterior spiracles; the posterior spiracles have three buds.

It seems possible that this may be a polyphagous species. Leaf-mines obtained at Colombo on *Quisqualis indica* Blanco. (Combretaceae) seem certainly referable to *atomella*, though no flies were bred. One fly was bred from a mine on *Eupatorium odoratum* L. at Labugama, Ceylon and this is not distinguishable from *atomella*.

Other records of leaf-mines (*K. A. S.*) which may be referable to the same species are: *Barringtonia acutangula* Gaertn. (Myrtaceae), Bombay, 5.i.1960; *Barringtonia asiatica* Kurz., Bangkok, 16.i.1960; *Bougainvillea spectabilis* Willd. (Nyctaginaceae), Bombay, 6.i.1960; *Flacourtia* sp. (Flacourtiaceae), Krishnagar, India, 12.i.1960.

Leaf-mines (fig. 9) obtained on *Cephalandra* (*Coccinia*) *indica* Naud., Bombay, 6.i.1960, appear conspicuously different but an adult bred by de Meijere (1940 : 130) from *Coccinia* in Java is indistinguishable from *atomella*. A specimen bred from *Dioscorea* in Java also appears identical. Séguy (1951) described as *M. dioscoreae* a species with the costa ending at vein *r5* bred from this genus on Madagascar.

M. atomella is extremely similar to *M. vigneae* (Séguy), 1951 from Africa and Madagascar, but this species has only been recorded on Leguminosae and the puparium is black.

M. styricicola Sasakawa, 1954, a polyphagous epidermal miner in Japan, is also similar to *atomella* but appears to be distinctly larger; specimens in my possession have a wing length of 2 mm.

Specimens in the D.E.I., Berlin, from Formosa, identified as *atomella*, do not agree with the holotype and are referred to *conspicua* sp. n. described below; specimens from Sumbawa (Rensch) are indistinguishable from *atomella* but differences in the male genitalia suggest that a further species may be involved. I consider it preferable, however, not to split the species further until additional bred series from known host-plants are available.

Melanagromyza atralis sp. n.[1]

Head : frons equal to width of eye, not projecting above eye in profile; 2 *ors*, 2 *ori*; orbital setulae reclinate, in single row; ocellar triangle prominent, apex almost reaching lower *ors*; jowls not deep but conspicuously rounded and extended in front (fig. 10); vibrissa strong, equal to lower *ors*; third antennal segment with distinct pubescence; arista short, slight, bare.

Wing : length in female 1·9 mm.; costa extending strongly to vein *m1* + *2*, *rm* beyond midpoint of discal cell, last segment of *m4* in ratio 13 : 17 with penultimate.

Legs : mid-tibiae with one weak postero-dorsal bristle.

Colour : frons, jowls matt black, ocellar triangle and orbits moderately shining; mesonotum and abdomen shining black, without trace of metallic coloration; wings clear, veins dark; squamae and fringe whitish.

Holotype ♀, INDONESIA: south of Flores, Poeloe Endeh, 11.vi.1927; 1 ♀ *paratype*, same data (*Rensch*), in D.E.I., Berlin.

The only other entirely black species with white squamal fringe known in the Oriental region is *M. alternata* Spencer from Formosa but this is a substantially more robust and larger insect.

Melanagromyza centrosematis de Meijere, 1940

INDONESIA: Java. FORMOSA: Tainan (Sung-Yang Lee). MALAYA: Selangor.

The type series in the Zoological Museum, Amsterdam, is in poor condition but I

[1] Additional specimens from Micronesia, including males, have recently been examined which show this species to belong correctly in the genus *Ophiomyia*. Specimens I bred in January, 1961 from stem-mines on *Vernonia cinerea* found near Calcutta airport proved to be this species; these mines are identical with those previously found at Bangkok and illustrated in fig. 40.

have recently examined additional specimens bred from the roots of *Glycine soja* on Formosa and the species can be briefly characterised as follows :

Small, entirely black species, with wing length 1·75 mm. ; jowls prominent, one-sixth vertical height of eye ; third antennal segment round, relatively large, arista long, bare ; mesonotum and abdomen highly shining black ; squamae grey, fringe black ; one strong bristle on mid-tibiae.

Although de Meijere describes the jowls as narrow, they are in fact prominent both in the Indonesian and Formosan specimens. The puparium is yellow.

The larva feeds in the young shoots and roots of *Centrosema pubescens* Benth. and *Glycine soja* and possibly other Leguminosae.

Comparison of genitalia confirms that this is Hennig's (1941 : 175) *Melanagromyza* spec. 7. The species has also recently been recorded in Tanganyika.

Melanagromyza cleomae sp. n.

Head : frons narrow, equal to width of eye, not projecting above eye in profile, 2 strong, equal *ors* ; 2 weaker *ori* ; orbital setulae numerous, irregular, predominantly reclinate ; orbits well defined, widening in area of lower *ors* ; lunule higher than semi-circle, narrow, enclosed by orbits, jowls one-seventh height of eye, cheeks linear ; third antennal segment slightly broader than long, rounded at end ; arista short, equal to width of eye, only slightly pubescent ; eye with short patch of hairs in male, bare in female.

Mesonotum : 2 + 0 *dc*, *acr* irregularly in 8 rows, some 4 rows extending to first *dc*.

Wing : length in male and female 2·3 mm. ; costa extending strongly to vein *m1* + *2*, *rm* well beyond centre of discal cell, last and penultimate segments of *m4* in ratio 16 : 27.

Legs : mid-tibiae with 2 small but distinct bristles.

Colour : frons matt black, orbits distinctly shining ; ocellar triangle scarcely shining, weakly differentiated ; mesonotum highly shining, predominantly black, but with variable metallic sheen from bluish to copper-green ; abdomen greenish-blue with traces of copper ; wings hyaline, veins dark ; squamae and fringe white ; halteres black.

Holotype ♂, Ceylon : Colombo, Zoological Gardens, 1.ii.1960 ; *allotype* ♀, Singapore, 29.i.60 ; *paratypes*, 2 ♂, 2 ♀, Singapore, 1 ♀, Ceylon : Colombo ; all on *Cleome graveolens* Rafin. (*K. A. S.*), in author's collection.

These flies were observed in some numbers on *Cleome* both in Singapore and Colombo and it seems established that this is the host-plant ; it remains to be discovered whether the species is a leaf-miner or feeds elsewhere on the plant.

Melanagromyza coffeae (Koningsberger)

Oscinis coffeae Koningsberger, 1897.
Melanagromyza coffeae Hering, 1940 (Spencer, 1959).

Indonesia : Java. India : Mysore.

This is one of the group of small, black epidermal leaf-miners and is best recognised by its characteristic wing venation (fig. 11). The wing length is 2 mm., with the costa extending only to vein *r4* + *5* and the last and penultimate segments of vein *m4* equal.

The species has also been recorded from Kenya and Tanganyika.

Melanagromyza compositarum sp. n.

This is a medium-sized, shining greenish species belonging to a complex of which Malloch (1914) described *producta*, *piliseta* and *lasiops* ; *M. prolifica*, which Malloch placed in the same group, is synonymous with *sojae* (Zehnt.). *M. producta* (Mall.) is recognisable by its small size, *M. lasiops* (Mall.) by its large size ; *M. piliseta* (Mall.) is a medium-sized species with conspicuously pubescent arista and eyes in

the male pilose. This new species agrees closely with *piliseta* but the eyes in the male are bare.

The distinctive features of this species are as follows:

Head: frons narrow, little more than width of eye, not projecting above eye in profile; 2 equal *ors*; upper *ori* equal to *ors*, lower *ori* weaker; orbital setulae regularly reclinate apart from one or two hairs in front; ocellar triangle relatively large, distinctly shining; jowls narrow, at most one-twelfth vertical height of eye; third antennal segment with distinct pubescence: arista conspicuously plumose, lateral hairs longer than on third antennal segment; eyes entirely bare in both sexes.

Legs: mid-tibiae with 2 conspicuous bristles.

Wing: length in male 2·3 mm., female somewhat longer; venation characteristic of this group.

Colour: mesonotum shining blackish-green with tendency to coppery; abdomen normally shining green but also sometimes becoming coppery; squamae and fringe white; head, pleura, legs black.

Holotype ♂, CEYLON: Labugama, 31.i.60; *paratypes*, 1 ♂, same data, caught on *Eupatorium odoratum* L., 2 ♀, CEYLON: Peredeniya, 2.ii.1960, caught on *Tithonia diversifolia*; all (*K. A. S.*), in author's collection.

Two males from FORMOSA in the D.E.I., Berlin, determined as *prolifica* (Malloch), are referable to this species; also one male from INDIA: Calcutta in the British Museum (Nat. Hist.).

It is suggested that the species is an internal stem-feeder on various Compositae.

Melanagromyza conspicua sp. n.

Head: frons only slightly wider than eye, not projecting above eye in profile; 2 equal *ors*, 2 *ori* scarcely weaker; *ors* and upper *ori* directed upwards, lower *ori* inwards; orbital setulae fairly numerous, reclinate; ocellar triangle short, not reaching lower *ors*; lunule small, narrow, higher than semicircle; jowls conspicuously deep in centre below eye, one-fifth vertical height of eye; cheeks linear; third antennal segment rounded, with long pubescence; arista of moderate length, shorter than height of eye.

Mesonotum: 2 + 0 *dc*; *acr* regularly in 8 rows, 2 rows extending behind first *dc*.

Wing: length in male 2 mm.; costa extending strongly to vein *m1* + *2*, *rm* at centre of discal cell, last segment of vein *m4* in ratio 15 : 21 with penultimate.

Legs: mid-tibiae with one strong bristle.

Male genitalia: aedeagus (fig. 42) differing from type normal in genus, distiphallus an elongate, sac-like structure, covered with minute, tubercle-like processes; spermal sac unusually large.

Colour: an all-black species; frons matt, ocellar triangle moderately shining; mesonotum deep black, shining from behind, more matt when viewed from front; abdomen shining black; wings hyaline, veins dark; squamae grey, fringe black; halteres black.

Holotype ♂, SINGAPORE, 29.i.60, swept on waste ground in town; *paratype* ♂, CEYLON: Peredeniya, 2.i.60; both (*K. A. S.*), in author's collection.

Two specimens from FORMOSA in the D.E.I., Berlin, determined by Hennig as *M. atomella* (Mall.) are referable to this species (confirmed by examination of genitalia). It is distinguishable from *atomella* by the larger size, the bristle on the mid-tibiae, deeper jowls and distinctly pubescent third antennal segment. The species resembles *M. centrosematis* de Meij. but is distinguishable by the less shining mesonotum and pubescent third antennal segment.

This species forms a clearly-defined group with a new species from Bonin, to be described shortly in the *Insects of Micronesia*, which is the only other species known so far to have the distinctive sac-like form of distiphallus.

Melanagromyza cordiophoeta sp. n.

Two males taken on flowers of *Cordia cylindristacha* at Singapore closely resemble

M. compositarum Spencer but comparison of the male genitalia shows the species to be distinct.

The new species differs from *compositarum* in the following respects :

Larger, more robust, wing length in male 2·5 mm. ; arista more conspicuously pubescent ; mesonotum darker, more blackish-green ; margins of squamae distinctly brownish, more differentiated ; aedeagus distinctive (fig. 43), dark brown, strongly chitinised for this genus ; ninth sternite and aedeagal apodeme both conspicuously black ; spermal sac large, only slightly shorter than aedeagus.

Holotype ♂ and one ♂ *paratype*, SINGAPORE : Neesoon, 29.i.60, on flowers of *Cordia cylindristacha* (*K. A. S.*); in author's collection.

It is suggested that the species may feed in the flower-heads of *Cordia*.

Melanagromyza dolichostigma de Meijere, 1922

Melanagromyza decora de Meijere 1922, **syn. nov.**

INDONESIA : Java, 1920. FORMOSA : Taipeh, 1958.

The type specimens were bred from the upper stems of *Glycine soja*, *Phaseolus radiatus* L., *P. calcaratus* L. and *P. vulgaris* L. in Java. The colour of the species is stated in the description to be greenish. I have been able to discover only two males, representing the type series, in the Zoological Museum, Amsterdam. One of these is preponderantly greenish, but is now without its head ; the other is shining black with a tendency to bluish. In my opinion, it is doubtful whether these represent the same species. *M. dolichostigma* can, however, be definitely recognised in the larval or pupal stage by the unique, long anterior spiracles ; these were figured by de Meijere (1922 : 19). The biology is discussed in detail by Van der Goot (1930 : 69–96).

I have recently studied specimens from Formosa, bred from " bean stems ", and photographs of the larva and puparium show beyond doubt that the species is *dolichostigma* ; fig. 12 is a sketch made from a photograph of the puparium. Essential characteristics of the species are as follows :

Frons narrow, equal to width of eye ; 2 strong *ors*, 2 weaker *ori* ; jowls narrow ; third antennal segment small, round ; arista distinctly plumose ; mesonotum largely shining blackish with tendency to purplish or bluish ; abdomen conspicuously variable, blackish-blue, -green, -red or -purple ; wing length 2–2·4 mm., first cross-vein at centre of discal cell, last segment of *m4* two-thirds length of penultimate ; squamae and fringe pale.

A characteristic feature of this species is the variable colour of the abdomen, which is basically black but with a conspicuous metallic sheen ranging from emerald green to brilliant blue, red and purple.

De Meijere noted this conspicuous reddish-purple coloration on one specimen among a number of bred *dolichostigma* and described it as a distinct species, *decora* de Meijere, 1922. This specimen agrees exactly with a number of the Formosan specimens and I therefore synonymise *decora* de Meij. with *dolichostigma* de Meij. herewith.

I consider the specimens bred from the upper stem and/or pods of Leguminosae, in which both abdomen and mesonotum are green, to represent an additional species. This complex can only be clarified when more bred material is available and it is possible to study the larva or puparium.

Melanagromyza erythrinae (de Meijere)

Agromyza erythrinae de Meijere, 1910.
Melanagromyza erythrinae (de Meij.), de Meijere, 1922.

INDONESIA : Java, Salatiga.

Holotype in Zoological Museum, Amsterdam, " bred from galls on leaves and petioles of *Erythrina lithosperma* Mig."

This is a medium-sized greenish species differing from *M. compositarum* Spencer and *piliseta* (Mall.) in having the wing base conspicuously whitish. It is said to be common all over Java.

Melanagromyza gerberivora Spencer (1960*a*)

India: Hyderabad, 10.ii.1956.

Holotype ♀, Division of Entomology, Pretoria, bred from stems of *Gerbera jamesonii* Bolus *ex* Hook *f*. The Indian specimens were bred from stems of *Carthamus tinctorius* L.

This is a large, shining green species with wing length 2·5–2·8 mm., characterised by narrow jowls, bare arista and eyes, in male, pilose; the posterior spiracles of the whitish puparium each have eight lightly chitinised buds arranged around a slender black horn.

Melanagromyza hibisci sp. n.

Head: frons broad, one and a half times width of eye, not projecting above eye in profile; two strong *ors*, 2 *ori* (missing in all specimens but detectable from conspicuous basal pits); ocellar triangle large, apex extending to lower *ors*; orbits prominent, widening anteriorly to lower *ori*, then sharply narrowing to base of antennae; lunule conspicuously high and narrow, upper margin at level of upper *ori* (fig. 13); jowls narrow but slightly widening at front; third antennal segment rounded, arista distinctly pubescent.

Mesonotum: 2 strong *dc*; *acr* coarse in 12 regular rows, only individual hairs extending to first *dc*.

Wing: length in male 2·5 mm., in female up to 2·8 mm.; costa extending strongly to vein *m1* + *2*, *rm* at mid-point of discal cell.

Legs: mid-tibiae with 2 strong bristles.

Colour: frons, jowls matt black; ocellar triangle and orbits only weakly shining, mesonotum shining greenish-black and variably coppery, abdomen similar; wings hyaline, veins pale, distinctly brownish at wing base; squamae and fringe whitish; halteres brownish-black.

The conspicuously high, narrow lunule immediately distinguishes this species from all others known in the Oriental region.

Holotype ♂, India: New Delhi, 1958, bred from leaf-mine on *Hibiscus esculentus* L.; *allotype* ♀ and *paratypes*, 3 ♂, 3 ♀, same data.

Holotype, allotype and 3 paratypes presented by Commonwealth Institute of Entomology to British Museum (Natural History), two paratypes in author's collection. A series of 8 specimens from Sumbawa and Flores in the D.E.I., Berlin, collected by Rensch, is also referred to this species.

Melanagromyza lasiops (Malloch)

Agromyza lasiops Malloch, 1914.
Melanagromyza lasiops (Malloch), Hennig, 1941.

Formosa: Kosempo and numerous other localities. Male holotype in Hungarian National Museum, Budapest.

This is a large, greenish-black species; the wing length of the holotype, which I have examined, is 3·2 mm. Other essential characteristics are narrow jowls, eyes pilose in male, in female "slightly pubescent" (Malloch, 1914), long arista which is conspicuously plumose.

The species closely resembles *M. seneciocaulis* Spencer, 1960 which was bred in South Africa from stems of *Senecio* spp. and has been swept by Hering in Abyssinia on *Guizotia abyssinica* Cass.; however, in the African species the arista is almost bare. It seems virtually certain that *lasiops* is also an internal stem-feeder.

Melanagromyza leguminum Bezzi, 1928

INDONESIA: Sumbawa (*Rensch, Sunda Expedition*).

This is a minute bluish-green species described from Fiji and bred "from pods of No. 51 C.T.W." The wing length of the male is 1·6 to 1·75 mm. and the female is slightly larger. The eyes are bare in both sexes, the ocellar triangle is conspicuously large and shining, the squamae and fringe are white.

Examination of male genitalia has confirmed that specimens from MICRONESIA: Palau and from INDONESIA: Sumbawa are identical with the type series from Fiji. The genitalia of the Palau specimen are being figured in a forthcoming paper in the *Insects of Micronesia*.

The species is clearly similar to *M. producta* (Malloch) from Formosa but the possible synonymy can only be established after examination of the genitalia of the male holotype in Budapest.

Melanagromyza metallica (Thomson)

Agromyza metallica Thomson, 1869.
Agromyza similis Lamb, 1912.
Melanagromyza metallica (Thomson), Spencer, 1959.

INDONESIA: Flores (*Rensch, Sunda Expedition*). PHILIPPINES: Luzon.

This is one of the complex group of shining green species and it can be recognised by the following combination of characters:

Eye in male with small patch of hairs at level of upper fronto-orbitals; arista distinctly pubescent; mesonotum and abdomen shining greenish, with varying traces of coppery coloration; squamae and fringe white; wing length 2·2 to 2·4 mm.

The male genitalia are distinctive, the distal section of the aedeagus appearing rough, being covered with minute sensory pores.

It was suggested (Spencer, 1960: 25) that this species feeds in the flower-heads of *Inula glomerata*. The genitalia of the species bred from *Inula* in South Africa have recently been examined and it has been confirmed that this represents a distinct species, which will be described elsewhere. *M. metallica* has now also been confirmed in Abyssinia, Congo, Seychelles, and Micronesia. In view of this very wide distribution it is believed that the species will prove to be a feeder on Compositae, either in the stems or flower-heads, and probably on a number of different genera.

Melanagromyza nigrisquama (Malloch)

Agromyza nigrisquama Malloch, 1914.
Melanagromyza nigrisquama (Malloch), Hennig, 1941.

FORMOSA: Tainan. INDIA: New Delhi.

This all-black species is similar to *M. provecta* (de Meijere) but is distinctly more robust, with wing length 2·7 mm., more projecting frons and deeper jowls. The cross-vein *rm* is at the anterior third of the discal cell.

Two males from New Delhi, bred from stem-galls on *Abutilon indicum* Sweet, are clearly referable to this species and the feeding habit is thus satisfactorily established. Malloch places 22 specimens as paratypes; there are 15 specimens from various localities in Formosa in the D.E.I., Berlin.

Melanagromyza obtusa (Malloch)

Agromyza obtusa Malloch, 1914.
Melanagromyza obtusa (Malloch), Hennig, 1941.
Melanagromyza weberi de Meijere, 1922.

FORMOSA: Sokotsu, Takao, Yentempo, Tainan. INDONESIA: Java, Flores. INDIA: numerous localities throughout the country. CEYLON: Peredeniya (*K. A. S.*).

Holotype and paratypes from Formosa in Hungarian National Museum, Budapest; other specimens from Formosa in D.E.I., Berlin. The first bred specimens, described as *Melanagromyza weberi* de Meij. and synonymized with *obtusa* by Spencer (1959: 264), were obtained in Java from pods of *Cajanus indicus* L. and *Flemingia* sp. The biology of the species has been discussed in some detail by Ahmad (1938) and Vengopal (1954) in India, where it is commonly known as the tur-pod fly. The white larva destroys the seeds in the pods of various Leguminosae and forms a reddish puparium; it frequently causes serious damage.

This is a large green species immediately distinguishable from all others by the greatly enlarged ocellar triangle, which extends to the margin of the lunule and is unusual in having a blunt, flat apex.

Melanagromyza phaseoli (Tryon)

Oscinis phaseoli Tryon, 1895.
Agromyza phaseoli Coquillet, 1899.
Agromyza destructor Malloch, 1916.
Melanagromyza phaseoli (Tryon), Spencer, 1959.

Indonesia: Java, Flores. Formosa: Tainan. Philippines: Luzon, Los Baños. Ceylon: Peredeniya, Koslanda, Trincomalee (Rutherford, 1914).

This is one of the most serious pests attacking young bean stems; the biology has been discussed in detail by Otanes (1918), Van der Goot (1930) and Hassan (1947). The species occurs in Australia, throughout the Pacific and most of the Oriental region and also in Africa.

The small black fly can be distinguished from all other similar species by the elongated, brilliantly shining ocellar triangle.

Melanagromyza piliseta (Malloch)

Agromyza piliseta Malloch, 1914.
Melanagromyza piliseta (Malloch), Hennig, 1941.

Formosa: Takao, Tainan, Kosempo. Ceylon: Peredeniya (*K. A. S.*). Indonesia: Sumbawa, Flores.

Holotype and paratypes in Hungarian National Museum, Budapest; further specimens in D.E.I., Berlin.

M. piliseta is a green species with a wing length of at least 2·6 mm. It has a conspicuously pubescent arista and in the male the eye has a distinct patch of hairs which was apparently overlooked by Malloch; these hairs are present both in the holotype and in other specimens from Formosa which I have examined in the D.E.I., Berlin.

This species agrees closely in general morphology with *metallica* (Thomson) and no constant differences have been detected apart from its larger size. Examination of male genitalia, however, has confirmed that the two species are distinct: in *piliseta* the distiphallus has a conspicuous, black, strongly chitinised paired process which is lacking in *metallica*.

Melanagromyza polyphaga sp. n.

A small, all-black species.

Head: frons slightly wider than eye, not projecting; 2 *ors*, upper slightly stronger; 2 *ori*, slightly weaker than lower *ors*, upper directed upwards, lower inwards; orbital setulae sparse but relatively long, reclinate; ocellar triangle inconspicuous, apex at lower *ors*, with weak furrow produced to margin of lunule; lunule broad but lower than semicircle; jowls narrow, one-tenth height of eye; vibrissa strong; third antennal segment rounded, weakly pubescent; arista long, slightly shorter than vertical height of eye, without conspicuous pubescence.

Mesonotum: 2 + 0 *dc*, *acr* in 8 fairly regular rows, ending shortly after second *dc*.

Wing : length in male 2 mm., costa extending strongly to vein *m1* + *2*, *rm* beyond centre of discal cell, last segment of *m4* two-thirds penultimate.

Legs : mid-tibiae with one strong bristle.

Colour : frons matt black, ocellar triangle only weakly shining ; mesonotum matt black from front, only moderately shining from rear ; abdomen entirely black, somewhat shining.

Leaf-mine : irregularly linear, upper-surface, epidermal, difficult to detect when fresh, later conspicuously whitish.

Puparium: 2·1 × 1·1 mm., matt black, remaining in pupal cradle in leaf, with anterior spiracles projecting through epidermis ; posterior spiracles with 3 buds ; apart from larger size and different colour, form basically similar to that of *M. atomella* (Mall.) (fig. 8).

Holotype ♂, CEYLON : Colombo, emerged 8.ii.60 *ex* epidermal leaf-mine found 31.i.60 on *Tylophora flava* Trimen (Asclepiadaceae) (*K. A. S.*) ; 1 *paratype* ♂, CEYLON : Labugama, bred *ex* leaf-mine on *Symplocos spicata* Roxb. (" bombu ") (Symplocaceae) (*K. A. S.*) ; both in author's collection.

This species is larger and more robust than *atomella* (Mall.) and differs in having a strong bristle on the mid-tibiae. It closely resembles *M. conspicua* Spencer but is readily distinguishable by the narrower jowls and less pubescent third antennal segment.

Leaf-mines which I consider belong to this species were also found on :

Allamanda cathartica L. (Apocynaceae), 2.ii.1960, CEYLON : Peredeniya.
Dregia volubilis Benth. (Logoniaceae), 2.ii.1960, CEYLON : Peredeniya.
Thevetia neriifolia Juss. (Apocynaceae), 1.ii.1960, CEYLON : Colombo ; 10.i.1960, INDIA : Calcutta.

Similar mines but with distinctly larger puparia were found on :

Smilax indica Burm. (Liliaceae), 12.i.1960, WEST BENGAL : Krishnagar.
Lasia heterophylla Schott. (Araceae), 16.i.1960, THAILAND : Bangkok.

It is unlikely that *M. polyphaga* would also feed on these genera belonging to the Dicotyledones and an additional species is probably involved.

Melanagromyza producta (Malloch)

Agromyza producta Malloch, 1914.
Melanagromyza producta (Malloch), Hennig, 1941.

FORMOSA : Pilam, Tainan, Paroe, Chipun, Taihoku.

Holotype and paratypes in Hungarian National Museum, Budapest.

This is a very small, shining green species ; the size is given by Malloch as 1·5 mm. The eyes are bare in both sexes ; the squamae and fringe are white.

It is possible that this species is synonymous with *M. leguminum* Bezzi from Fiji and confirmed by the writer from examination of genitalia in Palau and Sumbawa. This synonymy, however, cannot be established until the genitalia of the male holotype in Budapest can be examined.

Melanagromyza prolifica (Malloch)

Agromyza prolifica Malloch, 1914.
Melanagromyza prolifica (Malloch), Hennig, 1941.

This species is synonymised below with *sojae* (Zehntner).

Melanagromyza provecta (de Meijere)

Agromyza provecta de Meijere, 1910.
Melanagromyza provecta (de Meijere), de Meijere, 1922.

INDONESIA : Krakatau, Lombok, Flores, Sumbawa. FORMOSA : Paroe.

Holotype ♀, in Zoological Museum, Amsterdam.

Medium-sized, shining black species, wing length 2·3 mm. (not 1·75), frons distinctly projecting above eye, third antennal segment with conspicuous long pubescence, arista long; jowls relatively broad, one-seventh height of eye.

A female in the D.E.I., Berlin from Formosa (Hennig, 1941—spec. 11) is referable to this species, and also a long series collected by Rensch in 1927 (Sunda Expedition).

Melanagromyza ricini de Meijere, 1922

INDONESIA: Java, Flores, Sumbawa. FORMOSA: Tainan, Toa Tsui Kutsu.

Bred from fruits of *Ricinus* sp.; holotype in Zoological Museum, Amsterdam.

All-black species, with narrow jowls, frons not projecting above eye, bare arista, wing length 2·5 mm., black squamal fringe; mid-tibiae with 2 strong bristles, which clearly separate the species from the smaller *conspicua* Spencer.

Two specimens from Formosa in the D.E.I., Berlin agree closely with the holotype and are tentatively referred to this species; also five specimens from the Sunda Expedition (*Rensch*).

Melanagromyza sauteri (Malloch)

Agromyza sauteri Malloch, 1914.
Melanagromyza sauteri (Malloch), Hennig, 1941.

FORMOSA: Chip-chip.

Male holotype in Hungarian National Museum, Budapest, unique.

Fairly large black species, wing length 2·6 mm., with projecting frons, broad jowls, short arista; characteristic matt black mesonotum and conspicuously long orbital setulae.

Melanagromyza setigera (Malloch)

Agromyza setigera Malloch, 1914.
Melanagromyza setigera (Malloch), Hennig, 1941.

FORMOSA: Tainan, Koshun, Kankau, Takao.

Holotype and paratypes, Hungarian National Museum, Budapest; other specimens in D.E.I., Berlin.

This is a large, shining black species, with black squamal fringe and non-projecting frons; it is immediately recognisable by the prominent bristle on the fore tibiae. This bristle is characteristic of many *Japanagromyza* spp.; however, *setigera* lacks pre-scutellar bristles which are strongly developed in all other known *Japanagromyza* spp. Until the species can be studied further, I leave it in *Melanagromyza*.

Melanagromyza sojae (Zehntner)

Agromyza sojae Zehntner, 1900.
Melanagromyza sojae (Zehnt.), de Meijere, 1922.
Agromyza prolifica Malloch, 1914, **syn. nov.**

INDONESIA: Java, 1900; Flores, Sumbawa, 1927. FORMOSA: Taipei, 1959; Chip-Chip, Tainan, Takao, 1911. INDIA: Pusa ("bred from pea stems"), 19.xi.1935.

Zehntner's description is inadequate by modern standards and de Meijere (1922) redescribed the species, describing and figuring also the larva and puparium. Only a single specimen in poor condition, presumably the type, can be traced in the Zoological Museum, Amsterdam. I have recently, however, received from Formosa a bred series in perfect condition, in which the puparia agree exactly with de Meijere's illustration. The essential characteristics of the species are as follows:

Frons only slightly wider than eye; ocellar triangle large, distinctly but not brilliantly shining; jowls conspicuous, rounded, deepest in front, one-seventh height of eye; third antennal segment round, arista relatively long, almost bare; eyes bare in both sexes; mesonotum shining black, virtually no trace of metallic coloration, abdomen greenish; wing length 2–2·4 mm., *rm* normally well beyond mid-point of discal cell; squamae and fringe white.

Van der Goot (1930 : 54–68) has discussed the biology in some detail. The species is an internal stem-feeder in Leguminosae, the main hosts being *Glycine soja*, *Cajanus indicus*, *Phaseolus* spp.

I have examined the holotype of *prolifica* Malloch and also additional specimens from the Sauter collection in the Hungarian National Museum, Budapest and in the D.E.I., Berlin and I synonymise this species with *sojae* (Zehnt.) herewith. Malloch mentions the variation observed among the 52 specimens he placed as paratypes of *prolifica* ; I have not examined this series but it seems probable that other species are included among this material.

The Indian specimen was previously incorrectly identified as *cunctans* (Mg.) and the puparium was figured as this species (Spencer, 1959 : 267). Comparison with the specimens of *sojae* from Formosa shows that the puparium belongs to this species and it also agrees exactly with de Meijere's illustration of the posterior spiracles of the larva (1922 : 19). *M. cunctans* has 6–8 buds on the posterior spiracles of the larva and I have recently received a number of empty puparia of this species from Dr. Buhr, bred from stem galls on *Lotus corniculatus* L. in Corsica. The arrangement of the spiracles is conspicuously different from that of *sojae* ; the two spiracular processes are closer together and both arise from a pronounced spherical base.

I have not been able to find any consistent differences between the adults of these two closely-related species. It now remains to be established from bred material whether the African specimens determined as *cunctans* (Mg.) are in fact this species, *sojae* (Zehnt.), or an additional species.

Two specimens from Indonesia (Sunda Expedition) have been examined which agree closely with *sojae* but which are significantly smaller, with wing length 1·6 mm. More material will be required before it can be decided whether these represent a further species.

Melanagromyza subfusca (Malloch)

Agromyza subfusca Malloch, 1914.
Melanagromyza subfusca (Malloch), Hennig, 1941.

Formosa : Pilam.

Male holotype in Hungarian National Museum, Budapest, unique. A medium-sized shining-black species, wing length 2·3 mm., with projecting frons, narrow jowls, conspicuously plumose arista.

Melanagromyza theae (Green)

Agromyza theae Green, 1896.
Melanagromyza theae (Green), de Meijere, 1922

Ceylon : Peredeniya. India : Madras (Rau, 1944). Indonesia : Java.

A small, black epidermal leaf-miner, with the costa extending only to vein *r4* + *5* and the last segment of *m4* distinctly shorter than the penultimate. De Meijere (1922, 1940) discusses both the fly and the larva. A leaf-mine found by the author in Ceylon on 1.ii.1960 is shown in fig. 14.

The species has also been recorded in Japan.

5. **Ophiomyia** Braschnikov

This genus consists of four species in the Oriental region, including one new species from India described below.

The species can be identified by the following key :

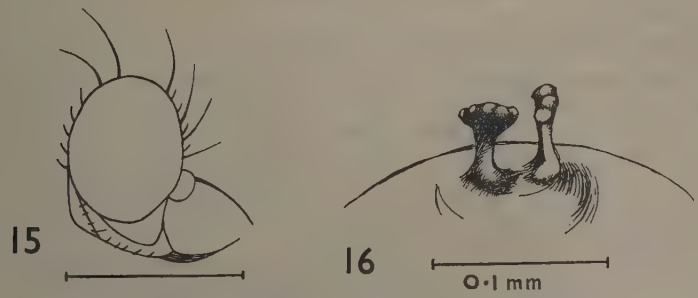
1	Squamae and fringe white	**cornuta** de Meijere
–	Squamae grey, fringe black	2
2	Facial keel broad, bulbous.	3
–	Facial keel narrow, linear, not protruding	**cicerivora***
3	Acrostichals extending only to second *dc*	**anguliceps** (Malloch)
–	Acrostichals extending in 3 or 4 rows to first *dc*	**lantanae** (Froggatt)

Ophiomyia anguliceps (Malloch)

Agromyza anguliceps Malloch, 1914.
Ophiomyia anguliceps (Malloch), Hennig, 1941 : 175.

Formosa : Tainan.

Examination of the female holotype from Budapest shows this species to be scarcely distinguishable from *lantanae* (Froggatt) and it is possible that the two are synonymous. One difference is that in *anguliceps* the acrostichals extend only to the level of the second *dc*, while in all specimens of *lantanae* I have seen they extend in 3 or 4 rows to the first *dc*. A decision on this possible synonymy can only be taken when more material, including males, is available from Formosa.



Figs. 15–16.—*Ophiomyia cicerivora* sp. n. : (15) head ; (16) posterior spiracles of puparium.

Ophiomyia cicerivora sp. n.

Head (fig. 15) : frons wide, almost twice width of eye, not projecting above eye in profile ; 2 *ors*, upper slightly stronger ; 2 *ori*, weaker than lower *ors*, lower directed inwards ; orbital setulae sparse, rather long ; orbits not conspicuously differentiated ; ocellar triangle large, well defined, apex extending to lower *ors* ; lunule flat, inconspicuous ; jowls one-quarter vertical height of eye, forming angle of 80° in front, almost flat below eye ; cheeks broad, three-quarters width of jowl ; vibrissal horn in male conspicuously broad at base ; facial keel dividing antennae narrow, scarcely widening, at broadest point narrower than base of vibrissal horn ; third antennal segment small, arista bare, relatively long.

Mesonotum : 2 strong *dc*, *acr* in 6–8 rows (at rear destroyed by pin).

Wing : length in male 2 mm. ; costa extending to vein *m1* + *2*, *rm* only slightly beyond mid-point of discal cell, *mm* own length removed from *rm*, last segment of *m4* shorter than penultimate, in ratio 16 : 22.

Colour : entirely black ; frons matt, orbits only weakly shining ; ocellar triangle conspicuously shining above, less so at apex ; mesonotum largely shining but less so when viewed from front ; wings hyaline, veins blackish-brown, squamae grey, fringe black, halteres black.

Puparium : 2·7 mm. long, whitish yellow ; anterior spiracles black, 0·08 mm. long, projecting through epidermis of stem, surmounted by asymmetrical knob bearing the buds (number not detectable) ; posterior spiracles (fig. 16) 2 mushroom-like processes, lightly chitinised, pale brownish, each with 6 buds.

Holotype ♂, Pakistan : Rawalpindi, bred *ex* gram stem, 15.iv.58, in British Museum (Natural History).

This is the only described species of this genus known to me feeding on Leguminosae and is readily distinguishable from all other species known in the Ethiopian and Oriental regions.

Ophiomyia cornuta de Meijere, 1910

Agromyza sp., Lamb, 1912.
Ophiomyia leucolepsis Bezzi, 1928.
Ophiomyia scaevolae Frick, 1953.
Ophiomyia cornuta de Meij., Spencer, 1959.

INDONESIA: Krakatau, holotype ♂, in Zoologisch Museum, Amsterdam. CHAGOS ISLANDS: a single specimen bred from leaf-mines on *Scaevola koenigii* Vahl.

Frick (1953) described as *scaevolae* specimens bred from *Scaevola frutescens* (Mill.) Krause from Canton Island in the Pacific and the author has recently seen specimens from many other Pacific Islands. The species belongs to the group with a white squamal fringe and was discussed in some detail by Spencer (1959).

Ophiomyia lantanae (Froggatt)

Agromyza lantanae Froggatt, 1919.
Ophiomyia lantanae (Froggatt), Spencer, 1959.

INDIA: Bangalore; Bombay, 5.i.1960 (*K. A. S.*); Calcutta, 10.i.1960 (*K. A. S.*). SINGAPORE: 29.i.1960 (*K. A. S.*). CEYLON: Colombo, 31.i.1960 (*K. A. S.*).

Beeson (1937) states that this species was introduced into Bangalore in 1921 and has since spread throughout India. I found it to be abundant on the flowers of *Lantana camara* L. at Bombay, Calcutta and Colombo, scarce in Singapore and apparently absent on Luzon, Philippines. Beeson considers the fly is not an important factor in controlling the spread of *Lantana*.

The species occurs widely in the Pacific and in Australia and has recently been introduced into Kenya, in an attempt to assist in the control of *Lantana*.

6. **Cerodontha** Rondani

This small, distinctive genus, recognisable by the presence of only two scutellar bristles, is represented in the Oriental region only by the semi-cosmopolitan *denticornis* (Pz.).

Cerodontha denticornis (Panzer)

Cerodontha acuticornis Mg., Malloch, 1914.
Cerodontha denticornis Pz., Hennig, 1941.

FORMOSA: Takao, Tainan. 3 specimens in Hungarian National Museum, Budapest.

The species has not been recorded elsewhere in the Oriental region but occurs sparsely in Africa (Spencer, 1959, 1960) and is widespread in the Palaearctic region.

7. **Phytobia** Lioy

This is the second largest genus in the Oriental region, with 15 recorded species, representing 19 per cent. of the total; the percentage in the Ethiopian region is only 8 per cent. The Oriental species include two present in the Palaearctic and Ethiopian regions and one Palaearctic species, *artemisiae* (Kalt.), which has extended its range to Southern China. *P. diversata* described below is unusual in having the scutellum yellow. A new leaf-miner on rice, *P. oryzivora*, from Malaya, is also described.

The Oriental species can be identified by the following key:

1 Halteres dark brown . . . . . (*Amauromyza*) **aliena** (Malloch)
– Halteres pale, white or yellow 2
2 Lunule conspicuously high and narrow . . . . . (*Poëmyza*) 3
– Lunule approximately semicircular 5
3 Orbits yellow; 3 + 0 *dc* . . . . . **javana** de Meijere
– Orbits dark, black or brown 4

4 Femora on hind legs entirely black ; 3 + 1 *dc* ; wing length 2·7 mm. **cornigera** de Meijere
– Femora with yellow knees on all legs ; 3 + 0 *dc* ; small species, wing length 1·6 mm. . . . . **oryzivora***
5 Antennae distinctly separated at base ; lunule broad, large 6
– Antennae adjoining 10
6 Ocellar triangle produced to margin of lunule ; frons yellow or brownish (*Icteromyza*) 7
– Ocellar triangle smaller ; frons brownish-black . . (*Dizygomyza*) **omissa***
7 Femora yellow . . . . . **piliseta** (Becker)
– Femora black, distally yellow 8
8 Last segment of vein *m4* longer than penultimate ; small species, wing length 1·7–2·2 mm. 9
– Last segment of *m4* shorter than penultimate ; large species, wing in female 2·7 mm. . . . . **nigricoxa** (Malloch)
9 Frons yellow, orbits black ; wing length 2·2 mm. . . . . **duplicata***
– Frons dark-brown ; smaller species, wing 1·7 mm. . . . . **floresensis***
10 Vein *r4* + *5* ending nearest apex of wing ; pre-scutellar bristles strongly developed . . . . . (*Phytobia*) 11
— Vein *m1* + *2* ending nearest apex of wing ; pre-scutellar bristles lacking . 12
11 Scutellum concolourous with mesonotum, grey or black . . **nigrita** (Malloch)
— Scutellum partially yellow (fig. 20) . . . . . **diversata***
12 Strong pre-sutural *dc* present . . . . . (*Praspedomyza*) 13
— Pre-sutural *dc* lacking . . . . . (*Calycomyza*) 14
13 Frons reddish-yellow . . . . . **frontella** (Malloch)
— Frons dark brown . . . . . **brunnifrons** (Malloch)
14 Orbits entirely yellow ; knee of fore femora yellow ; squamal fringe dark, brownish-black . . . . . **artemisiae** (Kaltenbach)
— Orbits largely black ; legs entirely black ; squamal fringe pale, whitish-yellow . . . . . **humeralis** (v. Roser)

Phytobia (Phytobia) diversata sp. n.

Head : frons broad, just over one and a half times width of eye, not projecting above eye in profile ; 2 strong, equal *ors* ; 2 *ori*, upper similar to *ors*, lower weaker and directed inwards ; orbital setulae minute, sparse, almost lacking ; orbits not pronounced ; ocellar triangle extending to lower *ors* ; jowls narrow, cheeks linear ; third antennal segment rounded, normal ; arista conspicuously long, equal to vertical height of eye.

Mesonotum : 3 + 1 strong *dc*, decreasing in size uniformly ; third and fourth equidistant before and after suture ; intra-alar equal to second *dc*, no inner post-alar ; distinct pre-sutural intra-alar present, just behind level of pre-sutural and front *dc* and nearer to pre-sutural ; 2 well-developed *prsc*, half length of second *dc* ; *acr* in 6 rows, a few hairs at level of first *dc*.

Wing (fig. 17) : length in female 2·5 mm. ; costa extending strongly to vein *m1* + *2*, *rm* at mid-point of discal cell, last segment of *m4* in ratio 25 : 20 with penultimate.

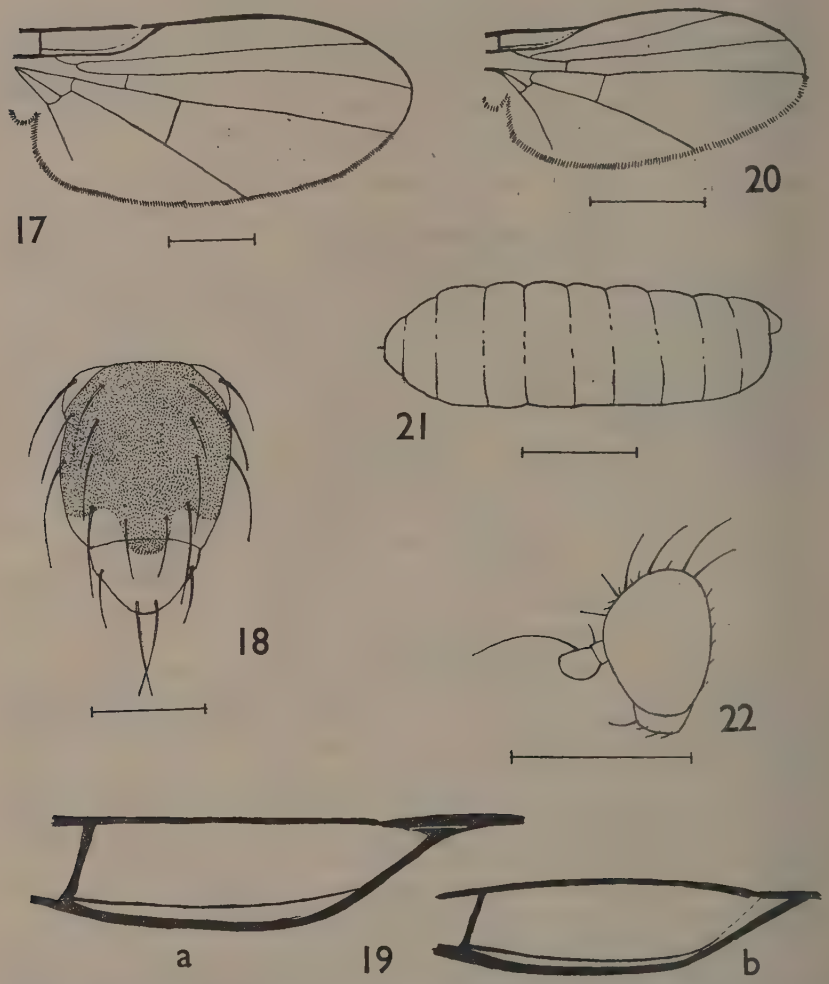
Legs : mid-tibiae with one strong postero-dorsal bristle.

Colour : head entirely black ; mesonotum (fig. 18) largely matt black, with two large yellow patches extending from scutellum to first *dc*, divided by central black area which extends from mesonotum on to scutellum ; scutellum otherwise yellow ; humeral callus black from front to humeral bristle, thereafter yellow and confluent with yellow notopleural area ; other pleura entirely black ; legs black ; abdomen yellowish-black ; first tergite black with narrow yellow hind-margin, other tergites with central black band, indistinctly yellow at sides and along hind-margins ; wings hyaline, veins black, yellowish at wing base ; squamae grey, fringe black ; halteres yellow.

Holotype ♀, Formosa : Paroe, north Paiwan Dist., viii.1912 (*H. Sauter*), D.E.I., Berlin. This is the specimen referred to by Hennig (1944 : 173) as *Liriomyza* spec.

This is a diverse species, similar only to *picta* Coquillett (*dorsocentralis* Frost), known from Mexico and Central America, which was described as an *Agromyza* but placed by Frick (1959 : 376) in *Phytobia*, sub-genus *Phytobia*. Both species have the

yellow scutellum characteristic of *Liriomyza* but differ from typical species of this genus not only in the black head but also in having a pair of strong pre-scutellars, a strong bristle on the mid-tibia and vein *r5* ending at the apex of the wing ; they agree with typical species of *Metopomyza* in the generally black coloration but lack the pronounced, raised orbits.



Figs. 17–22.—*Phytobia :* (17) *diversata* sp. n., wing ; (18) the same, mesonotum ; (19) sub-costa of (*a*) *Agromyza* sp., (*b*) *nigrita* (Mall.) ; (20) *oryzivora* sp. n., wing ; (21) the same, puparium ; (22) *omissa* sp. n., head.

I place *diversata* in *Phytobia*, sub-genus *Phytobia* and am confirmed in this decision by the presence of the distinct pre-sutural intra-alar bristle which is not found in *Liriomyza* or *Metopomyza* and only in some species of *Phytobia* (*Phytobia*).

Phytobia (*Phytobia*) *nigrita* (Malloch), 1914, **comb. nov.**

Agromyza nigrita Malloch, June, 1914.
Agromyza nigrita Malloch, Hennig, 1941 (as *atrata*).
Agromyza albohalterata de Meijere, November, 1914, **syn. nov.**

Formosa : Pilam, Takao, Toa Tsui Kutsu, Kosempo, Chipun, Kankau. Indonesia : W. Java, Depok.

Female holotype and 3 paratypes in Hungarian National Museum, Budapest. One male, three females in D.E.I., Berlin. I have recently examined a single specimen from Tanganyika, Marangu (*Lindner*) referable to this species.

This species was described as *nigrita* but in the accompanying key was referred to as *atrata*. Hennig (1941) used the latter name but I consider it preferable to follow the name used in the actual description.

I am satisfied that this species correctly belongs in *Phytobia*, sub-genus *Phytobia*.

The species of this sub-genus closely resemble certain *Agromyza* species but careful examination of the sub-costa shows that it continues to the costa at least as a fold, and does not distinctly coalesce with vein *r1*. Vein *r1* does not noticeably broaden as it joins the costa, as it does in *Agromyza* species (fig. 19*a*), but remains at approximately the same strength throughout its length (fig. 19*b*). In many specimens there is a distinct pre-sutural intra-alar bristle. The orbital bristles are conspicuously strong.

I have examined the single specimen of *albohalterata*, in the Zoological Museum, Amsterdam, and synonymise it herewith with *nigrita* (Malloch). De Meijere described the species as an *Agromyza* but later (1922 : 23) correctly suggested that it belonged to *Dizygomyza* (= *Phytobia*).

The species has a broad, matt black frons, small, silvery lunule, a distinctly large third antennal segment, 3 + 1 strong *dc*. The wing length is 3 mm., with the costa extending strongly to vein *m1* + *2* and the last and penultimate segments of vein *m4* approximately equal.

Phytobia (*Poëmyza*) *cornigera* de Meijere, 1934

Java : Gedeh (Tapos, 800 m.), iii.1933, bred from leaf-mines on a species of Cyperaceae. Type in Zoological Museum, Amsterdam.

Largely black species with wing length 2·7 mm. ; knees on fore and mid legs yellow, hind femora entirely black ; pleura and abdomen also black ; somewhat resembling the African species *P. magnificans* Spencer, 1959, but in this all knees are bright yellow and notopleural area also yellow.

Phytobia (*Poëmyza*) *javana* de Meijere, 1934

Java : Gedeh (Tapos, 800 m.), xi.1932 ; Bandjar, 50 m., iii.1932. Bred from leaf-mines on *Panicum palmifolium* Poir. and two other grasses. Types in Zoological Museum, Amsterdam.

The species has striking, broad yellow orbits and in this character, and generally, resembles *P. orbitona* Spencer, 1960, from South Africa. The species are immediately distinguishable by the coloration of the legs : in *javana* the knee on the fore-legs is bright yellow but the femora on the mid and hind legs are entirely black ; in *orbitona* the femora on all legs are yellow on the distal two-thirds.

Phytobia (Poëmyza) oryzivora sp. n.

Head : frons at foremost ocellus one and a half times width of eye ; orbits distinctly projecting above eye, enormously widening anteriorly, at widest point together occupying seven-eighths distance between eyes ; lunule very high and narrow, height equal to half distance between base of antennae and foremost ocellus ; ocellar triangle small, not extended ; 2 *ors*, the upper slightly longer ; 2 weak, hair-like *ori*, both directed largely upwards ; orbital setulae conspicuously large and numerous, particularly in front ; jowls elongated at rear, cheeks forming narrow ring below eye ; third antennal segment small, rounded ; arista long, plumose.

Mesonotum : 3 well-developed *dc* ; small presutural 4th possibly present (mesonotum damaged) ; *acr* coarse in some 6 rows, not extending behind first *dc*.

Wing (fig. 20): length in male 1·6 mm. *rm* at mid-point of discal cell, last segment of vein *m4* long, in ratio 17 : 11 with penultimate.

Colour: head predominantly matt black; frons at apex of ocellar triangle and second antennal segment distinctly brownish; mesonotum largely matt black, somewhat shining from behind; abdomen similar; pleura black, notopleural area slightly brownish; legs black, all knees bright yellow; wing base bright yellow; squamae and fringe pale, yellowish; halteres whitish.

Puparium (fig. 21): 1·9 mm. × 0·8 mm., bright orange, segments deeply indented, with no apparent bands of tubercles. Anterior spiracles 2 minute finger-like projections, posterior spiracles scarcely differentiated, not detectable; anus forming conspicuous, rounded protuberance.

Holotype ♂, MALAYA: Kuala Lumpur, 17.xi.1939, bred ex *Oryza sativa* L., in British Museum (Natural History).

This is one of the smallest known *Poëmyza* species and its leaf-mine on rice can no doubt easily be overlooked. It has the enormously widened orbits found also in *P. javana* de Meij., *orbitona* Spencer and *setariae* Spencer but in these three species the orbits are bright yellow.

Phytobia (Icteromyza) duplicata sp. n.

Head: frons bright yellow, orbits conspicuously black to upper *ori*.

Wing: length in male 2·2 mm.

Male genitalia: general form similar to *P.* (*I.*) *floresensis* but paired tubules of distiphallus substantially longer and for anterior sixth up to junction with terminal process conspicuously swollen, less chitinised and paler (fig. 44); spermal sac large, twice as long as in *floresensis*. In all other characters resembling *P.* (*I.*) *floresensis* Spencer.

Holotype ♂, INDONESIA: Flores, Sadiawa, 1,200 m., 17.vi.27 (*Sunda Expedition, Rensch*), in D.E.I., Berlin.

This species closely resembles *floresensis* but is immediately recognisable by the yellow frons and larger size. It is very similar to the Palaearctic species *P.* (*I.*) *geniculata* (Fallén) (*cf.* Hendel, 1936 : 53), the only external difference being in the more darkened orbits. The genitalia of *geniculata* are quite distinct: the median and distal sections of the aedeagus are pale, lightly chitinised, more membranous and quite straight.

Phytobia (Icteromyza) floresensis sp. n.

Head: orbits slightly projecting above frons anteriorly, distinctly widening in front; 2 *ors* and 2 *ori* (broken, relative lengths not detectable); orbital setulae minute; apex of ocellar triangle at level of lower *ors*; lunule relatively high and broad; jowls angular, distinctly produced at rear; vibrissa conspicuous; third antennal segment small, round, arista very long, equal to vertical height of eye, distinctly pubescent.

Mesonotum: 3 + 1 *dc*, *acr* coarse in 4 or 5 rows, extending slightly behind level of second *dc*.

Wing: length in male 1·7 mm.; costa extending strongly to vein *m1* + *2* which ends at apex of wing. First cross-vein at mid-point of discal cell; last segment of *m4* in ratio 17 : 12 with penultimate.

Colour: frons and orbits dark brown with trace of yellow undertone; lunule yellowish; jowls, face and palps yellow; antennae predominantly black, tip of second segment and first slightly yellowish; mesonotum and pleura moderately shining black; legs: coxae distally yellowish, femora black but broadly yellow at knees, tibiae and tarsi black; squamae yellowish, fringe ochreous; halteres yellow.

Male genitalia (fig. 45): distal and median sections of aedeagus dark brown to black, heavily chitinised, with characteristic curvature, identical in the 2 specimens examined; basal section chitinised at each end and behind, otherwise membranous; long paired tubules of distiphallus each terminating in a small process in form of an inverted triangle.

Holotype ♂, INDONESIA: Flores, Endeh, 10–16.vi.27 (*Sunda Expedition, Rensch*), in D.E.I., Berlin; 1♂ paratype, same data. There is a further male without its head, with the same data.

Phytobia (*Icteromyza*) *nigricoxa* (Malloch)

Agromyza longipennis Loew var. *nigricoxa* Malloch, 1914.
Dizygomyza nigricoxa (Malloch), Hennig, 1941.

Formosa: Takao, 3 specimens in Hungarian National Museum, Budapest; Tainan, 1 ♀, D.E.I., Berlin.

Malloch (1914 : 317) suggested that *nigricoxa* might well be distinct from *longipennis* (Loew) and after comparing the female in Berlin with two specimens of *longipennis* in the U.S. National Museum, Washington, I am satisfied that it is correct to raise *nigricoxa* to specific rank. The differences may be tabulated as follows:

nigricoxa (Malloch)	*longipennis* (Loew)
Orbits yellow, though *vti* on black.	Upper orbits from lower *ors* black.
Coxae entirely black.	Fore- and mid-coxae partially yellow.
Femora black, yellow at apex for distance equal to width of femora, on fore femora yellow slightly more extensive.	All femora yellow on anterior third.
Tibiae yellow on lower side, darker brown above.	Tibiae black.
Last segment of vein *m4* in ratio 20 : 27 with penultimate.	Last and penultimate segments of vein *m4* equal.

Wing length of female in both species 2·7 mm.

Phytobia (*Icteromyza*) *piliseta* (Becker)

Agromyza piliseta Becker, 1903.
Dizygomyza (*Icteromyza*) *piliseta* (Beck.), Hendel, 1936.
Phytobia (*Icteromyza*) *piliseta* (Beck.), Spencer, 1959.
Agromyza flavofemorata Malloch, 1914, **syn. nov.**
Dizygomyza flavofemorata (Mall.), Hennig, 1941.

Formosa: Polisha, Taihoku, Paroe. 1 ♂, Hungarian National Museum, Budapest; 1 ♂, 2 ♀, D.E.I., Berlin.

I have examined the specimens in the D.E.I., Berlin and synonymise herewith *Agromyza flavofemorata* Malloch with *Phytobia* (*Icteromyza*) *piliseta* (Becker).

Spencer (1959) recorded *piliseta* from the Cape Verde Islands, Rhodesia and the Seychelles; I have also recently examined specimens from Micronesia.

Phytobia (*Amauromyza*) *aliena* (Malloch)

Agromyza aliena Malloch, 1914.
Dizygomyza aliena (Malloch), Hennig, 1941.

Formosa: Sokotsu. Holotype ♀, Hungarian National Museum, Budapest; Sokotsu, 1 ♀; Paroe, 1 ♀, D.E.I., Berlin.

This is an entirely black species, with low lunule and dark brown halteres, which are slightly paler, yellowish, on the inside. The wings are clear and veins pale; length 2·2 mm. It closely resembles *A. triseta* Spencer, 1959, from South Africa but the African species is larger, wing length in male 2·7 mm., has broader, more differentiated orbits and distinctly brownish wings with black veins.

Phytobia (*Calycomyza*) *artemisiae* (Kaltenbach)

Agromyza artemisiae Kaltenbach, 1856.
Dizygomyza (*Calycomyza*) *artemisiae* (Kalt.), Hendel, 1936.

China: Canton, bred from leaf-mines on "*te foo tsai*", 2 ♀, in British Museum (Natural History).

This species is common in Western Europe, is known from Japan, and is possibly at the southern limit of its range at Canton. The larva forms a conspicuous blotch mine on *Artemisia* spp. and also on *Eupatorium cannabinum* L.

Phytobia (Calycomyza) humeralis (v. Roser)

Agromyza humeralis v. Roser, 1840.
Dizygomyza humeralis v. Roser, Hendel, 1936.

INDONESIA: E. Sumbawa, Dompoe, 1 ♀, 24–25.v.1927, Sunda Expedition (*Rensch*).

This species is a leaf-miner on *Aster* and *Erigeron* and occurs widely in the Holarctic region and also in Africa. The main characteristics of the species are:

Frons yellow with darkened orbits, legs entirely black, mesonotum shining black, notopleural area and upper margin of mesopleura bright yellow, squamae and fringe whitish.

Phytobia (Praspedomyza) brunnifrons (Malloch)

Agromyza brunnifrons Malloch, 1914.
Dizygomyza brunnifrons (Malloch), Hennig, 1941.

FORMOSA: Kosempo, holotype ♀, Hungarian National Museum, Budapest; Toa Tsui Kutsu, 1 ♀, D.E.I., Berlin.

Hennig (1941 : 173) suggests that the single specimen in the D.E.I. is possibly not *brunnifrons* Malloch, although it runs to this species in Malloch's key. The differences cited, however, are not substantial and I accept this specimen as belonging to Malloch's species.

It is a typical *Praspedomyza*, with three post-sutural and one pre-sutural dorsocentral bristle, dark brown frons with raised orbits and otherwise largely black. The wing length is 2·7 mm.; it is thus an appreciably larger insect than the two Palaearctic species *morio* (Brischke) and *approximata* Hendel. It closely resembles a new species *flavomaculata* Spencer (1960*b*), recently discovered by the author in Spain, but this is quite distinct with a bright yellow notopleural area.

Phytobia (Praspedomyza) frontella (Malloch).

Agromyza frontella Malloch, 1914.
Dizygomyza frontella Malloch, Hennig, 1941.

FORMOSA: Pilam. Holotype ♀, Hungarian National Museum, Budapest.

After examining the holotype I place this species in the genus *Phytobia*, and tentatively in the subgenus *Praspedomyza*. There is a distinct but small fourth presutural *dc* present, the frons is reddish-yellow with the conspicuous orbits darkened above. The wing, which is figured by Malloch, measures 1·9 mm. and not 1·25 as stated by Malloch. Malloch's description is otherwise accurate and reasonably detailed. The species superficially resembles the Palaearctic species, *morio* (Brischke).

Phytobia (Dizygomyza) omissa sp. n.

Head (fig. 22): frons broad, twice width of eye, not projecting above eye in profile; 2 *ors* directed upwards, 2 *ori* directed predominantly inwards; upper 3 equal, lower *ori* weaker; orbital setulae slight, sparse, some reclinate, others distinctly proclinate; lunule large, broad, upper margin semicircular; ocellar triangle short, apex not reaching lower *ors*; jowls narrow, slightly rounded; cheeks linear; antennae widely separated at base, third segment in female rounded below, with distinct angle above; arista moderately plumose.

Mesonotum: 3 + 1 *dc*, acrostichals irregularly in 5 rows.

Wing: length in female 2·2 mm.; costa weak between veins *r4* + *5* and *m1* + *2*, *rm* at midpoint of discal cell, last and penultimate segments of *m4* equal.

Colour: frons brown, blacker in front; orbits and jowls pale brown; face blackish-brown; antennae black, second segment more brownish; mesonotum and abdomen largely shining black, more matt from front; pleura black; upper and hind margins of mesopleura and wing base distinctly yellow; femora black, knees on fore legs yellowish, on others scarcely differentiated;

tarsi and tibiae more brownish ; wings hyaline, veins brown ; squamae yellowish, margins brown, fringe ochreous.

Holotype ♀, FORMOSA : Paroe, N. Paiwan district, x.1912 (*H. Sauter*), in D.E.I., Berlin. Hennig (1941 : 174) referred to this specimen as *Dizygomyza* spec.

A male from INDONESIA, East Lombok, Selong, 2.iv.1927 (*Rensch*) clearly belongs to the same species. The only detectable differences are the smaller size, wing length 1·8 mm., and the greatly enlarged third antennal segment, a characteristic found in the male in most species of this subgenus.

8. **Liriomyza** Mik

This genus is represented in the Oriental region by only six species, accounting for 8 per cent. of the total in the region. This is basically similar to the distribution in the Ethiopian region. In the Palaearctic and Nearctic regions the genus is substantially larger.

The species in the Oriental region can be identified by the following key :

1	Mesonotum narrowly yellow adjoining scutellum . . .	**subpusilla** (Malloch)
–	Mesonotum and scutellum concolorous, grey or black	2
2	Second cross-vein lacking ; mesonotum matt grey ; only two rows of acrostichals	**haplomyzina***
–	Second cross-vein present ; mesonotum more shining, black ; acrostichals present in at least four rows	3
3	Orbits normally black or brownish	**brassicae** (Riley)
–	Orbits entirely yellow	4
4	Both *vti* and *vte* on black ground	sp. 2 (ex *Pisum*)
–	At least *vti* on yellow ground	5
5	*vti* on yellow ground, *vte* on black	**compositella** Spencer
–	Both *vti* and *vte* on yellow ground	sp. 1 (Formosa)

Liriomyza brassicae (Riley)

Agromyza brassicae Riley, 1884.
Liriomyza cruciferarum Hering, 1927.
Liriomyza brassicae (Riley), Spencer, 1959.

INDIA : New Delhi, on cauliflower, 1958. SINGAPORE : bred *ex* leaf-mines on *Cleome graveolens* Rafin., 8.ii.1960 (*K. A. S.*). PHILIPPINES : Manila, leaf-mines on *Cleome graveolens*, 28.i.1960 (*K. A. S.*). CEYLON : Colombo, leaf-mines on *Gynandropsis speciosa* D. C., 1.ii.1960, and on *Cleomegraveolens*, 31.i.1960 (*K. A. S.*).

This species occurs widely throughout the world as a pest on cultivated cruciferous plants but records recently obtained by the author show that it is also widespread in Asia on indigenous plants. The leaf-mine on *Cleome* is shown in figure 23.

Liriomyza compositella **nom. nov.** for *pusilla* Malloch, *nec* Meigen, 1830

Agromyza pusilla Meigen, Malloch, 1914.
Liriomyza pusilla Malloch, Hennig, 1941.

FORMOSA : Tainan, Takao, Taihoku. INDIA : Bombay, bred from leaf-mines on *Solidago canadensis* L., 6.i.60 (*K. A. S.*). CEYLON : Peredeniya, bred from leaf-mines on *Tithonia diversifolia* A. Gray and *Gynura lycopersicifolia* D. C. (*K. A. S.*).

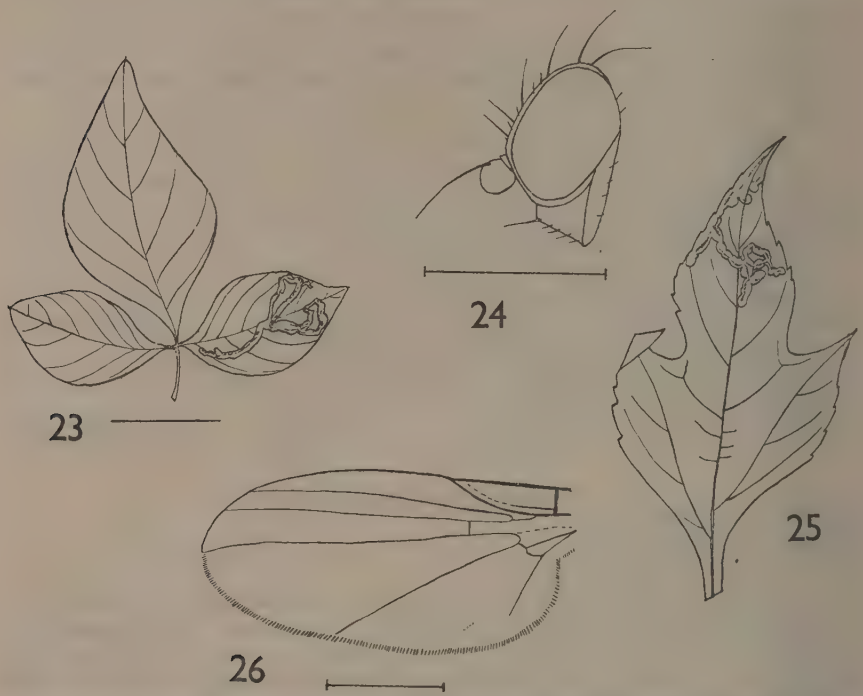
Malloch (1914) referred nine specimens from Formosa to *Agromyza pusilla* Meigen. Hennig (1941) noted that the species was indeed close to *pusilla* Mg. but found distinct differences in the genitalia and re-named the species *pusilla* Malloch, correctly referring it to *Liriomyza*. This homonym, however, is invalid and I therefore re-name Malloch's species *compositella*, for which confirmed host-plants are now recorded.

Hendel (1936) restricted *pusilla* Mg. to the species feeding on *Hieracium* and new species *sonchi* Hendel and *taraxaci* Hering were described as distinct species feeding

on *Sonchus* and *Taraxacum* respectively. I have recently re-examined this complex and find that the characters used by Hendel to separate the species are inconstant. De Meijere (1934 : 275) noted that he had not so far found any differences in the larvae from the three hosts. The blotch mines formed by the larvae in the three hosts appear identical. It is now my opinion that a single species is involved, *pusilla* Mg.

The leaf-mine of the new species immediately establishes it as distinct from *pusilla* Mg. ; one satisfactory character for separating the adults is that in *pusilla* both *vti* and *vte* are on yellow ground, while in *compositella* the *vte* is on black ground.

The species can be redescribed as follows :



FIGS. 23–26.—*Liriomyza :* (23) *brassicae* (Ril.), leaf-mine on *Cleome graveolens* ; (24) *compositella* nom. nov., head ; (25) the same, leaf-mine on *Tithonia diversifolia* ; (26) *haplomyzina* sp. n., wing.

Head (fig. 24) : frons almost one and a half times width of eye ; orbits slightly raised above frons and just visible above eye in profile ; 2 equal *ors* directed upwards ; 2 weaker equal *ori* directed inwards and upwards ; orbital setulae slight, sparse, reclinate, from before lower *ori* to upper *ors* ; jowls extended at rear, in centre below eye one-fifth height of eye ; cheeks forming narrow ring below eye ; vibrissa equal to lower *ori* ; third antennal segment round, with short but distinct pubescence.

Mesonotum : 3 + 1 *dc*, decreasing uniformly in size ; distance between second and first greater than between second and third ; second at level of intra-alar and distinctly in front of supra-alar ; *acr* irregularly in 4 rows.

Wing : length in female 1·9 mm., in male 1·6 mm., *rm* at mid-point of discal cell ; *mm* opposite termination of vein *r1* ; last segment of *m4* two and a half times length of penultimate.

Colour : frons, jowls, antennae bright yellow ; *vti* on yellow ground, *vte* distinctly on black ; hind-margin of eye black ; mesonotum shining black, yellow patches at hind-corners small ; pleura predominantly yellow ; mesopleura black along lower margin, extending upwards only as shadow, if at all ; sternopleura largely black, yellow on upper margin ; hypopleura yellow with

shadowy black undertone ; legs : coxae narrowly black where adjoining body, remainder bright yellow, femora bright yellow, tibiae and tarsi contrasting dark brown ; abdomen mainly black but bright yellow at extreme sides of tergites ; wings hyaline, veins dark ; squamae greyish, margins and fringe dark brown ; halteres yellow.

Puparium : orange-brown, deeply segmented ; posterior spiracular processes elongated, blackish, each surmounting broad-based protuberance and bearing some 20 minute buds ; anterior spiracles with some 10 buds arranged in regular oval on short projection.

Leaf mine (fig. 25) : linear, on upper surface, winding irregularly, with frass in conspicuous strips at side of channel.

Liriomyza haplomyzina sp. n.

Head : orbits greatly widening anteriorly, conspicuously projecting above eye in profile at base of antennae ; 2 *ors* directed upwards, 2 *ori* directed inwards ; orbital setulae lacking ; lunule semicircular, upper margin just above level of upper *ori* ; jowls angular, deeply extended at rear ; cheeks forming broad ring below eye.

Mesonotum : 3 + 1 strong *dc* ; *acr* in only 2 rows, extending only to level of second *dc* ; intra-alar hairs entirely lacking.

Wing (fig. 26) : length in female 1·9 mm. ; cross-vein *mm* absent.

Colour : head, including entire hind margin of eye, yellow ; first and second antennal segments yellow (third missing) ; mesonotum conspicuously matt grey ; pleura predominantly yellow ; mesopleura with narrow black band along lower and front margins ; sternopleura and hypopleura black in lower half ; legs entirely yellow, tarsi slightly darker, more brownish ; abdomen moderately shining black, all tergites with yellow hind-margins, broadly yellow at sides ; squamae yellow (fringe damaged) ; halteres bright yellow.

Holotype ♀, Indonesia : E. Lombok, Selong, 21.iv.27 (*Rensch, Sunda Expedition*), in D.E.I., Berlin.

This is a distinctive species, immediately recognisable by the matt-grey mesonotum, two rows of acrostichals and absence of the second cross-vein. These are three of the four characters accepted by Frick (1959 : 412) as defining species of the genus *Haplomyza*, the fourth being the presence of only a single upper orbital bristle. On this definition this species must be placed in *Liriomyza*, since two upper orbitals are clearly present.

Liriomyza subpusilla (Malloch)

Agromyza subpusilla Malloch, 1914.
Liriomyza subpusilla (Malloch), Hennig, 1941.

Formosa : Tainan.
Holotype ♂ in Hungarian National Museum, Budapest.

Unique species, with small semi-circular area of mesonotum adjoining scutellum yellow ; hind-margin of eye entirely yellow ; mesonotum matt greyish-black ; wing length 1·4 mm., first cross-vein well before centre of discal cell. Head and wing are figured by Malloch.

Liriomyza sp. (1)

Formosa : Taihoku, 1 ♀ in D.E.I., Berlin.

This specimen differs from any others I have seen from the Oriental region in the following characters :

Both *vti* and *vte* on yellow ground ; hind margin of eye largely yellow, with only a narrow section beyond *vte* black ; mesopleura largely yellow, with only a small area on lower margin black ; all tergites with bright yellow hind margins. The species otherwise closely resembles *compositella* Spencer.

I prefer not to describe it as a new species until additional material is available.

Liriomyza sp. (2)

MALAYA: Tanah rata, 2 ♂, bred *ex* leaf-mines on *Pisum sativum* L., 9.v.1939 (*H. T. Pagden*).

These specimens cannot be identified as *L. trifolii* (Burgess), which occurs commonly on *Pisum* and other leguminous crops in the Holarctic region and which can be recognised by the two rows of acrostichals and matt mesonotum. They are remarkably similar to *compositella* Spencer, differing primarily in the *vti* being just on black ground; it is, however, improbable that *compositella* will also occur on Leguminosae.

In view of the difficulty in describing *Liriomyza* spp. of this group without an adequate series, I prefer to wait until more material is available or confirmation can be obtained from larvae or leaf-mines, before describing these specimens as a new species.

9. **Phytagromyza** Hendel

This small genus is represented by only a single species in the Oriental region.

Phytagromyza atrata (Malloch)

Napomyza atrata Malloch, 1914.
Phytagromyza atrata (Malloch), Hennig, 1941.

FORMOSA: Takao, Tainan, Paroe. Holotype ♀ in Hungarian National Museum, Budapest; 3 ♀ in D.E.I., Berlin. INDONESIA: Sumbawa, Besar. 1 ♂, 1 ♀ (*Rensch*). INDIA: 1 ♀, Calcutta, Botanical Gardens, 9.i.60 (*K. A. S.*).

Typical *Phytagromyza*, with second cross-vein present, in continuation of or just basad of first; prescutellars lacking; brown squamal fringe distinctly contrasting with pale, whitish-grey squamae; second costal segment relatively short, only twice length of fourth.

This species resembles the African species, *P. acanthacearum* Spencer, but in the latter the second costal segment is longer and the squamal fringe paler.

10. **Pseudonapomyza** Hendel

This genus was erected by Hendel (*cf.* 1936 : 302) for the single Palaearctic species *atra* (Mg.), having a conspicuous angle to the third antennal segment and characteristic wing venation with a short costal segment between veins *r1* and *r2*.

Hennig (1941) transferred *spicata* Malloch to this genus from *Phytomyza* and this species agrees completely with Hendel's concept. Spencer (1959) transferred *alternantherae* Séguy to *Pseudonapomyza* from *Phytomyza*; this species has a round third antennal segment.

Malloch (1914) described *spicata* from two caught specimens from Formosa. This name has subsequently been applied to specimens bred from leaf-mines on sugar-cane and corn on Fiji (Bezzi, 1928 and Malloch, 1935) and from Hawaii by Frick (1952), where it is reported that the species feeds on 14 different species of Gramineae.

In January, 1960 I obtained leaf-mines with puparia on *Eragrostis* sp. at Bombay which proved to be identical in the form of the mine and puparia with specimens obtained later the same month from mines on *Cynodon dactylon* at Singapore; two flies were bred from the Singapore leaf-mines. The larva of this species mine singly and the puparium is firmly glued inside the mine by frass.

On 26th January I found mines on *Rottboellia exaltata* at Laguna, Luzon, Philippines. In this case up to five larvae were found mining together and the puparia were only lightly attached inside the mine. The puparium differs significantly from the Bombay-Singapore species.

I have also been able to examine five puparia of a species of this complex from mines on corn (*Zea*) on Guam, Mariana Islands. These puparia are covered with

conspicuous papillae, similar to those found in the Palaearctic species *atra* (Mg.). A puparium of a specimen from Hawaii, bred from sugar cane, agrees exactly with the Micronesian specimens.

On the basis of this evidence, it became clear that three distinct species are involved, and it is believed that reliable morphological differences between the species have been discovered.

I have been able to examine the holotype of *spicata* (Malloch) and found that it is a male and not a female as stated by Malloch. Examination of the male genitalia reveals distinctive differences in the three species.

The genitalia of the holotype of *spicata* (Malloch) agree closely with those of three specimens I have examined from Guam and it can thus be accepted that the identification as *spicata* of specimens from Hawaii, and almost certainly Fiji and Samoa, also, is correct.

Examination of male genitalia has provided confirmation that *alternantherae* (Séguy) is a true *Pseudonapomyza*, although the third antennal segment is rounded and without the characteristic angle found in other species.

In recent papers (1959, 1960) I have referred African specimens of this genus to *spicata* (Malloch). Examination of genitalia of specimens from Pretoria, South Africa and Addis Ababa, Abyssinia shows that they are not *spicata* (Malloch), as defined above, but closely resemble the Philippine specimens. Leaf-mines and larvae will be required before their exact systematic position can be established.

Further studies are now being undertaken which suggest strongly that it will not be possible to maintain *Pseudonapomyza* and *Phytagromyza* as separate genera. The differences in wing venation used by Hendel to justify the creation of separate genera are not supported by parallel differences in genitalia ; and a species has recently been found in Africa by Dr. Hering with typical *Phytagromyza* venation but puparial papillae identical to those found in the *atra-spicata* complex.

The Oriental species can be identified by the following key (including also larval characters) :

1 Third antennal segment round . . . . . **alternantherae** (Séguy)
– Third antennal segment with distinct angle at upper corner 2
2 Mesonotum largely shining black ; upper corner of third antennal segment with fine point ; puparium with conspicuous papillae on each segment **spicata** (Malloch)
– Mesonotum distinctly matt ; upper corner of third antennal segment more elongated, blunter ; puparium without long papillae, at most with short tubercles 3
3 Acrostichals not extending beyond second *dc* ; wing base conspicuously whitish ; larvae mining singly, entirely without papillae ; puparium without conspicuous segmentation, matt, dark brown . . . . . **asiatica***
– Acrosticals extending beyond second *dc*, almost to first ; wing base brown ; numerous larvae in one mine, with short, stout tubercles on each segment ; puparium with pronounced segmentation, shining, pale brownish-yellow **philippinensis***

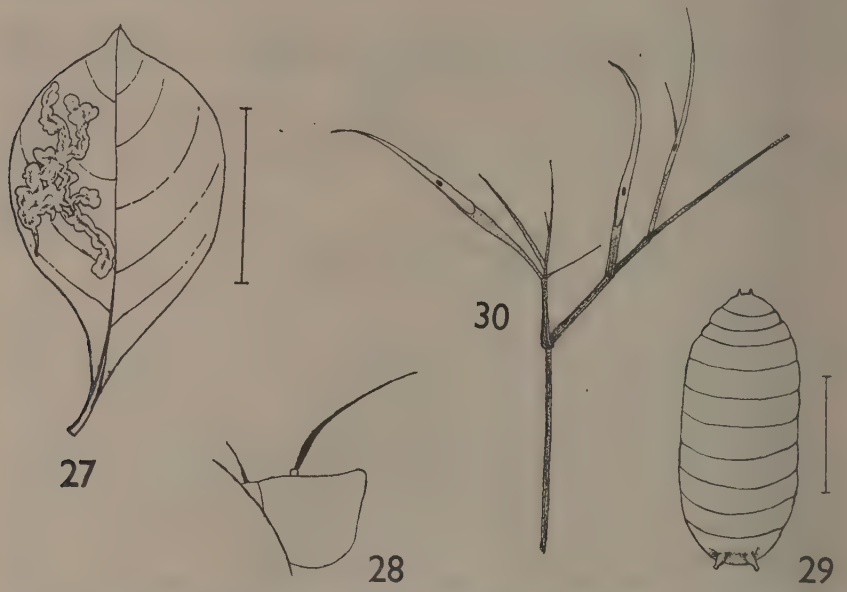
Pseudonapomyza alternantherae (Séguy)

Phytomyza alternantherae Séguy, 1951.
Pseudonapomyza alternantherae (Séguy), Spencer, 1959.

India : Bombay, bred from leaf-mines on *Achyranthes aspera* L. (*K. A. S.*) ; Calcutta, Botanical Gardens, swept on *Achyranthes aspera* (*K. A. S.*). Ceylon : Colombo, empty leaf-mines found 2.ii.1960 (*K. A. S.*).

The species has not previously been recorded from the Oriental region but is known from Madagascar and West Africa. The leaf-mine on *Achyranthes* is shown in figure 27.

The puparium bears distinct papillae that closely link the species with the *spicata* group ; in the male genitalia the ninth sternite has substantially broader arms than in the other species of the group but the large black postgonites are completely typical ; the distal section of the aedeagus is unusual in ending in two short, paired tubules.



FIGS. 27–30.—*Pseudonapomyza :* (27) *alternantherae* (Séguy), leaf-mine on *Achyranthes aspera* ; (28) *asiatica* sp. n., third antennal segment ; (29) the same, puparium ; (30) the same, leaf-mine.

Pseudonapomyza asiatica sp. n.

Head : frons not projecting above eye in profile, slightly wider than width of eye ; one *ors*, 3 *ori* ; orbital setulae minute, upright or reclinate ; apex of ocellar triangle at level of *ors* ; jowls broad, produced at rear ; third antennal segment with distinctive angle at upper corner (fig. 28).

Mesonotum : 3 *dc*, third at most half length of second ; distance between first and second double that between second and third ; *acr* irregular, in 4 rows, extending only to level of second *dc*.

Wing : length in male 1·6 mm., in female 1·75 mm. ; costal ratios between veins *r1* and *r2 + 3*, *r2 + 3* and *r4 + 5*, *r4 + 5* and *m1* are 20 : 9 : 12 and 22 : 10 : 14, respectively ; veins *r2 + 3* and *r4 + 5* are pale brownish, *m1 + 2* and *m3 + 4* represented by folds.

Colour : head entirely black, orbits only slightly differentiated, paler, slightly greyish ; lunule similar ; mesonotum black, distinctly matt but with slight subshine ; wing base pale, whitish ; squamae and fringe conspicuously silvery-white ; halteres entirely white.

Male genitalia (fig. 46) : distiphallus black, heavily chitinised ; median section and ventral appendages small, half length of distiphallus ; spermal sac strongly chitinised.

Puparium (fig. 29) : size, 1·6 × 0·75 mm. ; uniformly matt, dark brown ; posterior spiracles widely separated, surmounting conical base, with apparently 5 lightly chitinised bulbs ; anterior spiracles minute, closely adjoining, with indeterminate number of bulbs ; segmentation inconspicuous but each segment boundary marked by band of 4 or 5 rows of irregularly placed black tubercles ; surface otherwise largely smooth, without any trace of papillae.

Leaf-mine (fig. 30) : a conspicuous whitish mine is formed at the apex of the leaf on various Gramineae and the puparium is firmly glued inside the mine by a mass of black frass extending along all abdominal segments ; each mine contains only a single larva.

Holotype ♂, SINGAPORE, 29.i.60, bred *ex* leaf-mines on *Cynodon dactylon* (L.) Pers.; *allotype* ♀, same data (*K. A. S.*); both in author's collection. Leaf-mines on *Eragrostis* sp., Bombay, i.1960 (*K. A. S.*) and also one female from INDIA: Hyderabad, mining on rice, ii.1957 in the British Museum (Nat. Hist.) are also referable to this species.

I have now re-examined the four females from Formosa in the D.E.I., Berlin, determined as *spicata*. Three are correctly identified but one specimen from Taihoku lacks the characteristic third antennal segment of *spicata* and is almost certainly *asiatica*. This is the first evidence that at least two species of this complex may occur together.

The species is readily distinguishable from *philippinensis* by the larva (or puparium), leaf-mine and male genitalia; the adult is distinguishable by the paler wing base and squamae and by the less numerous acrostichals. It is distinguishable from *spicata* by the differing third antennal segment and less shining mesonotum.

Pseudonapomyza philippinensis sp. n.

This species agrees closely with *asiatica* Spencer in morphology and it is thus only necessary to indicate the points of difference:

Head (fig. 31): third antennal segment with broad angle at upper corner.

Mesonotum: matt black, *acr* strong, in 4 to 5 irregular rows, extending almost to first *dc*.

Wing (fig. 32): length both in male and female 1·75 mm.; wing generally darker, veins *r2* + *3* and *r4* + *5* strong, black; wing base brownish-yellow but not noticeably differentiated; squamae greyish-white.

Male genitalia (fig. 47): aedeagus with conspicuously elongated distal section and ninth sternite strikingly more chitinised than in the related species; spermal sac greatly enlarged, 0·27 mm. long.

Puparium (fig. 33): yellowish, highly shining and deeply segmented; posterior spiracles each appear to have an ellipse of some 10 bulbs, darkly chitinised on upper half; each segment bears dorsally 10 short, stout projections extending around the central, highest part of the segment; projections largest on terminal abdominal segments; the deep intersegmental boundaries have narrow bands of minute black tubercles.

Leaf-mine (fig. 34): a number of larvae feed together, forming a large brownish leaf-mine on Gramineae; the puparia are lightly attached inside the mine; frass is deposited in small, scattered grains.

Holotype ♂ and *allotype* ♀, PHILIPPINES: Luzon, Laguna, 2.ii.60, bred *ex* leaf-mine on *Rottboellia exaltata* L. f. (*K. A. S.*), in author's collection.

The species has distinctive genitalia; it is distinguishable externally from *spicata* (Mall.) by the blunter angle on the third antennal segment and the matt mesonotum, and from *asiatica* Spencer by the more numerous acrostichals.

Pseudonapomyza spicata (Malloch)

Phytomyza spicata Malloch, 1914.
Pseudonapomyza spicata (Malloch), Hennig, 1941.

FORMOSA: Tainan, Takao. PACIFIC ISLANDS: Micronesia, Hawaii, Fiji, Samoa.

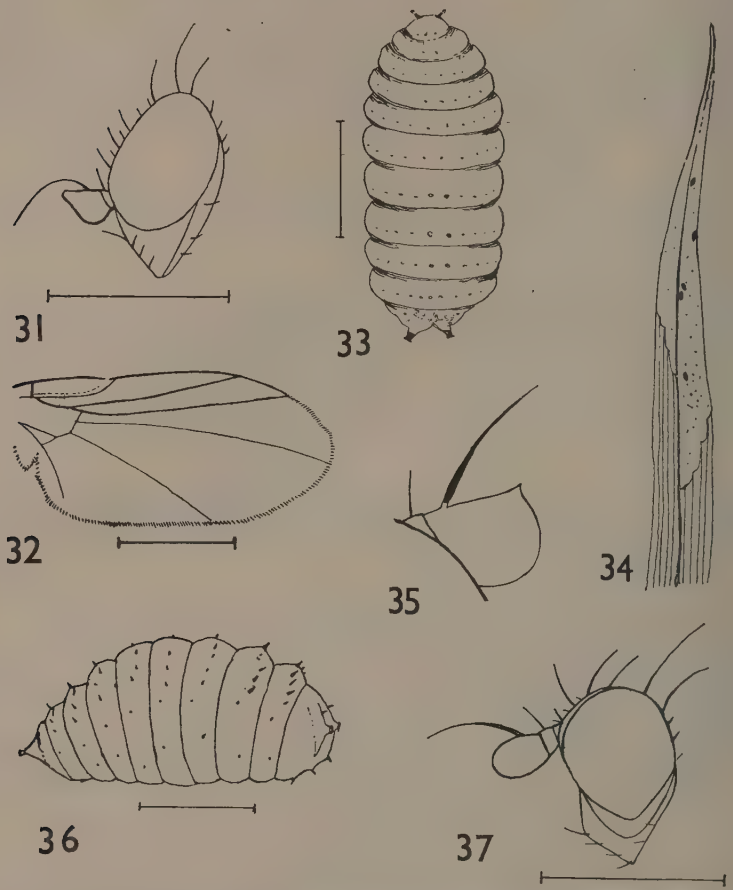
Malloch gave an adequate general description of this species; morphologically it is extremely close to *asiatica* Spencer and *philippinensis* Spencer but is immediately recognisable by the fine point on the third antennal segment (fig. 35) and by the more shining mesonotum.

The species has been recorded as a leaf-miner on *Zea mays* (corn, maize) in Fiji (Malloch, 1935), on sugar, corn and in all 14 species of Gramineae in Hawaii (Frick, 1952), and a caught specimen has also been recorded in Samoa (Malloch, 1935).

The genitalia of the holotype have been examined. The aedeagus (fig. 48) has a

blackish, strongly chitinised distal section ; the median section is of almost equal length, with conspicuous ventral appendages (hypophallus). The aedeagus agrees exactly with specimens from Guam and Hawaii, although the spermal sac appears somewhat lighter in the Pacific specimens.

No bred material is available from Formosa but the puparium of the Pacific specimens is covered in characteristic papillae (fig. 36), similar to those found in the Palaearctic species *atra* (Mg.).



Figs. 31–37.—(31–36) *Pseudonapomyza* : (31) *philippinensis* sp. n., head ; (32) the same, wing ; (33) the same, puparium ; (34) the same, leaf-mine ; (35) *spicata* (Mall.), third antennal segment ; (36) the same, puparium. (37) *Phytomyza tropica* sp. n., head.

11. **Phytoliriomyza** Hendel

Hendel (1936) proposed *Phytoliriomyza* as a subgenus of *Liriomyza* ; it was raised to generic status by Frey (1941). It has the following distinctive characters : orbital setulae proclinate, costa extending to vein *m1*, second cross-vein present. Only five world species are known, two from North America, one from Hawaii (Frick, 1953), one from Europe and *perpusilla* (Meigen) with a semi-cosmopolitan distribution.

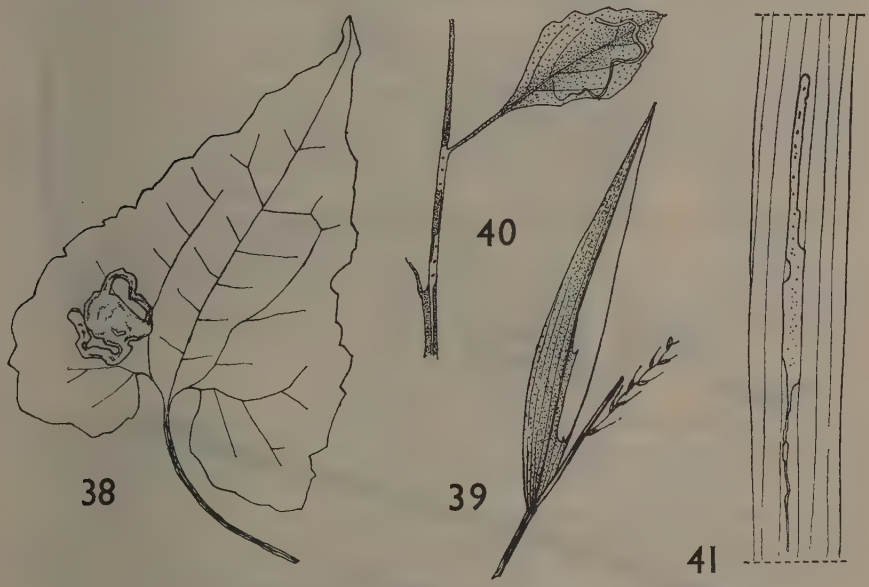
Phytoliriomyza perpusilla (Meigen)

Agromyza perpusilla Meigen, 1830.
Agromyza formosensis Malloch, 1914.
Phytoliriomyza perpusilla (Meigen), Hendel, 1936.
Phytoliriomyza formosensis (Malloch), Hennig, 1941, **syn. nov.**

Formosa: Taihoku, Daitotei, nine specimens.

Two specimens of *formosensis* (Malloch) I have examined have the penultimate and ultimate sections of vein *m3* + *4* in the ratio 11 : 19 and 13 : 20. Frick (1953 : 213), in a key to world species, separates *formosensis* from *perpusilla* by the relatively longer last segment of vein *m3* + *4* in the latter, which is stated to be more than twice as long as the penultimate. However, I have European specimens in my possession where the ratio is 15 : 22 and a separation on this character cannot be justified. In all other respects *formosensis* agrees exactly with *perpusilla* and I therefore establish this new synonymy herewith.

The species is known from Europe, North America, Cape Verde Islands and Basutoland (Spencer, 1959); it has not yet been recorded from Japan.



Figs. 38–41.—Leaf-mines: (38) *Mikania scandens*; (39) *Oplismenus compositus*; (40) *Vernonia cinerea*; (41) *Zea mays*.

12. **Phytomyza** Fallén

The distribution pattern of this genus in the Oriental region, where it is represented by only four species, closely resembles that of the Ethiopian region; the genus accounts for 5 per cent. of species in the Oriental, 9 per cent. in the Ethiopian region.

The Oriental species can be identified by the following key:

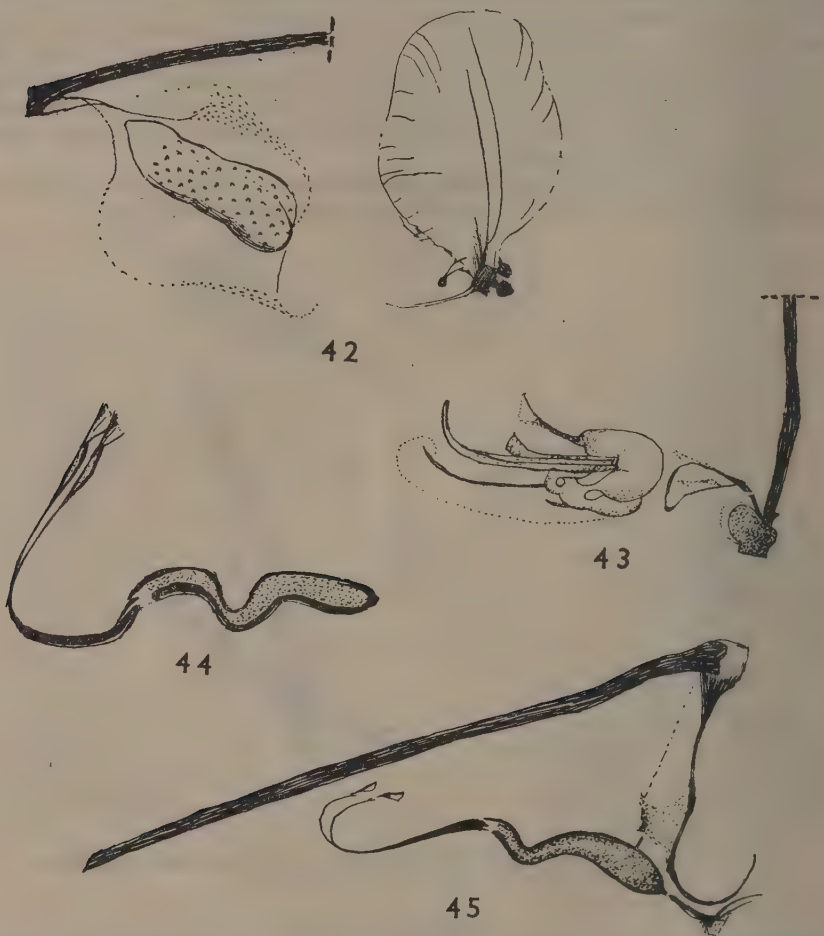
1	*acr* entirely lacking	**atricornis** Meigen
–	*acr* present	2
2	Mesonotum shining black, notopleural area yellow	sp. (Flores)
–	Mesonotum largely matt, greyish-black; notopleural area grey	3
3	Frons brownish-yellow behind, black in front; *acr* in two rows . . .	**tropica***
–	Frons bright yellow; *acr* irregularly in four rows	**robustella** Hendel

Phytomyza atricornis Meigen

Phytomyza subaffinis Malloch, 1914.
Phytomyza atricornis Mg., Hennig, 1941.

Formosa: numerous localities, specimens in Hungarian National Museum, Budapest and D.E.I., Berlin. India: Calcutta, bred from leaf-mines in *Aster* sp., 15.i.1960 (*K. A. S.*).

Hennig (1941) correctly synonymised *subaffinis* Malloch with *atricornis* Mg. This



Figs. 42–45.—(42–43) *Melanagromyza*: (42) *conspicua* sp. n., aedeagus, lateral view, and spermal sac; (43) *cordiophoeta* sp. n., aedeagus, lateral view. (44–45) *Phytobia*: (44) *duplicata*, sp. n., median and distal sections of aedeagus; (45) *floresensis* sp. n., aedeagus.

cosmopolitan species appears to be fairly abundant on Formosa but elsewhere in the purely tropical parts of Asia it is distinctly uncommon.

Phytomyza robustella Hendel

Phytomyza robusta Hendel, 1936 : 470.
Phytomyza robustella Hendel, 1936 : 567, *nom. nov.* pro *robusta* nec Meunier, 1905.

Formosa: Taihoku.

One male in Hungarian National Museum, Budapest, det. Malloch as *affinis* Fallén. I have examined this specimen and find that it agrees exactly with European examples of *robustella*. This species is larger and more robust than *affinis* and the black on the upper orbits extends to the base of the *vti*, which in *affinis* is on yellow ground. Hendel (1936 : 471) reports having seen this species from Siberia and Kamchatka. It is frequently swept in meadows in Western Europe and is believed to be a stem or root feeder.

Phytomyza tropica sp. n.

Head (fig. 37) : frons twice width of eye, distinctly projecting above eye in profile ; orbits pronounced, narrowing anteriorly but slightly more projecting above eye at level of antennae ; 2 equal *ors*, lower nearer upper margin of lunule than apex of ocellar triangle ; one strong *ori* at upper margin of lunule, and short hair in front ; orbital setulae sparse, in single row ; lunule broad, semicircular ; jowls deep, one-third height of eye ; cheeks conspicuously broad below eye, half width of jowls ; antennae large, third segment longer than broad ; palpi black.

Mesonotum : 3 + 1 strong *dc* ; *acr* sparse, in 2 rows, ending just behind second *dc*.

Wing : length in male 2·2 mm. ; second costal segment slightly more than twice length of fourth, in ratio 33 : 15.

Abdomen : epandrium normal, not conspicuously enlarged.

Colour : frons black in lower half, brownish-yellow above ; upper orbits black, *vti* and *vte* on black ground ; lower orbits brownish-yellow, lunule more distinctly yellowish ; jowls and cheeks yellow, face darkened, greyish ; antennae uniformly greyish-black ; mesonotum matt greyish-black, pleura similar ; abdomen black, tergites with narrow yellow borders ; legs largely black, fore coxae distally yellowish, knees on fore femora inconspicuously yellow ; squamae greyish-yellow, fringe black.

Holotype ♂, INDONESIA : Lombok, Sembaloen, 10–12.iv.27 (*Rensch, Sunda Expedition*), in D.E.I., Berlin.

This species superficially resembles the Palaearctic *P. cineracea* Hendel, but is distinguishable by the narrower orbits, larger lunule, and less numerous orbital setulae ; and by the yellow orbits, cheeks and fore coxae (grey in *cineracea*).

Phytomyza sp. (Flores)

A single imperfect specimen from INDONESIA : W. Flores, Sadiawa, 17.vi.27 (*Rensch, Sunda Expedition*) appears to be referable to an undescribed species. The actual description will be better left until additional material is available.

Distinctive species with brilliantly shining black mesonotum and bright yellow humerus, notopleural area and upper margin of mesopleura ; frons broad, twice width of eye, frons and jowls bright yellow ; first and second antennal segments black (third missing) ; jowls deep, rounded ; wing length 2·2 mm. ; abdomen missing.

In the formation and colour of the head this species closely resembles the Palaearctic species *sphondylii* R.-D. but differs in the conspicuously shining mesonotum.

13. *Additional Unidentified Species*

1. Leaf-miner on *Ischaemum timorense* Kunth.

Empty mines were found on this grass at Labugama, Ceylon on 31.i.1960 (*K. A. S.*). The mine appears similar to that on maize but it cannot be decided without additional material whether the same species is concerned.

2. Leaf-miner on *Mikania scandens* Willd.

Empty leaf-mines were found on this host at Singapore on 27.i.1960 (*K. A. S.*). The mine (fig. 38) winds irregularly and may produce a secondary blotch. Pupation takes place outside the mine.

3. Leaf-miner on *Oplismenus compositus* (L.) Beauv.

Empty mines were found on this grass at Singapore, 29.i.1960 (*K. A. S.*). The mine (fig. 39) is initially linear but later widens and may fill most of the leaf at one side of the mid-rib. Frass is deposited in fine, scattered grains.

FIGS. 46–48.—*Pseudonapomyza*, male genitalia: (46) *asiatica* sp. n.; (47) *philippinensis* sp. n.; (48) *spicata* (Mall.).

4. Leaf- and stem-miner on *Vernonia cinerea* Less.[2]

Mines with larvae were found on *Vernonia cinerea* at Bangkok, Thailand, on 17.i.1960 (*K. A. S.*). The mine (fig. 40) is initially a narrow linear, upper surface channel, then changing to the lower surface and leading into the midrib and finally

[2] The species forming these mines has recently been identified as *Melanagromyza* (=*Ophiomyia*) *atralis* Spencer (cf. p. 69).

down the stem. Frass is deposited in conspicuous, widely-spaced black lumps. The one adult larva was accidentally lost.

5. Leaf-miner on *Zea mays* L.

Empty leaf-mines were found on maize at Bangkok on 16.i.1960 (*K. A. S.*) and similar mines on the same host at Los Baños, Luzon, Philippines on 26.i.1960. The mine (fig. 41) is initially narrowly linear, later widening to a maximum of 3 or 4 mm. and then continuing with parallel sides between two veins. The frass is deposited in distinct, irregularly scattered grains. The larva leaves the mine to pupate.

Professor Hering has examined remains of a dead larva from one of these mines and considers that the species belongs to the subfamily Phytomyzinae.

V. References

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